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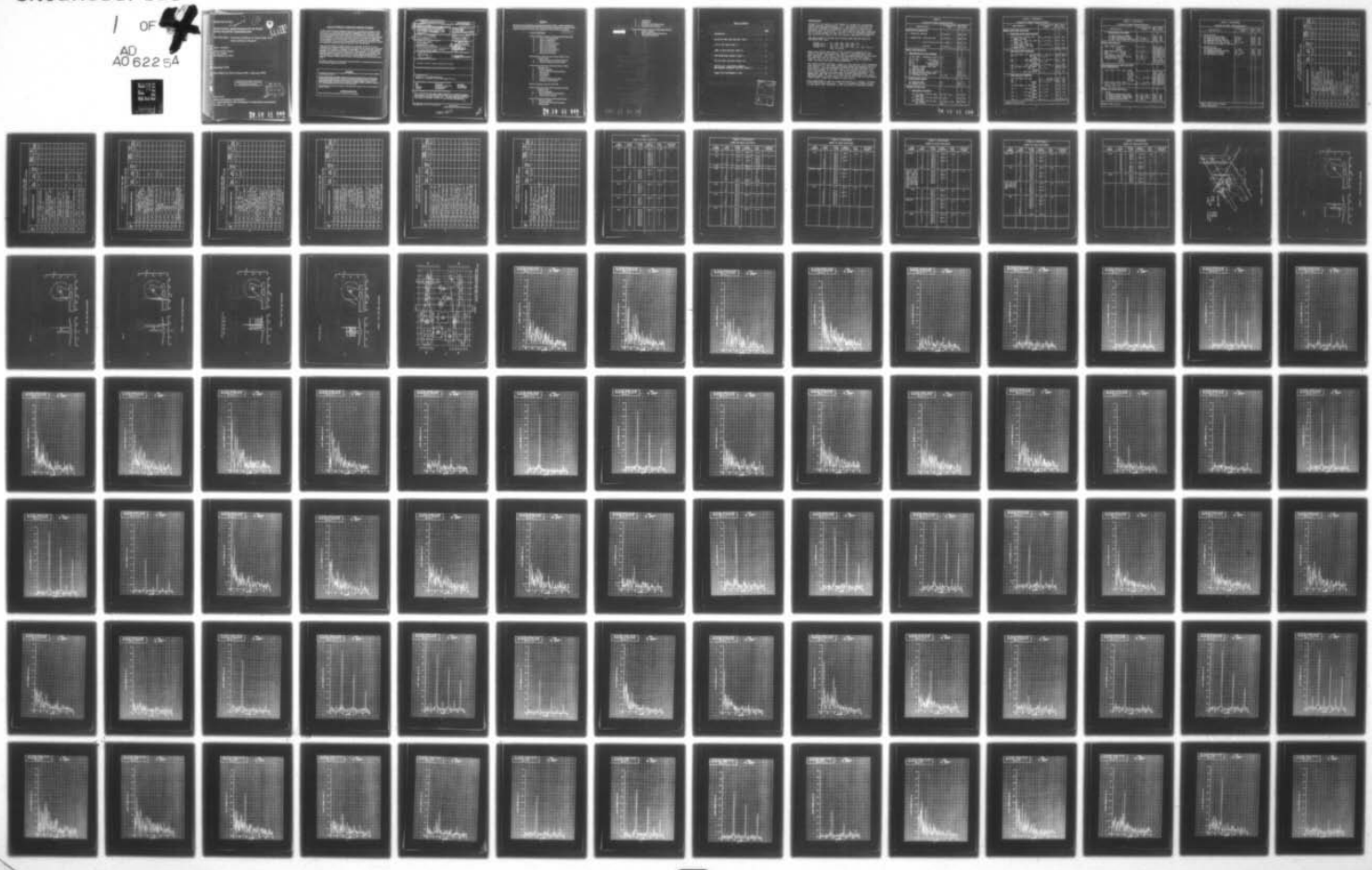


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LEVEL III

INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION

VOLUME VIII-A - Frequency Analyses of Wake Single Film Data, Buildup to Baseline

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P.O. Box 16858
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September 1978

Final Report for Period March 1977 - February 1978

Approved for public release; distribution unlimited.

Prepared for

APPLIED TECHNOLOGY LABORATORY
U. S. ARMY RESEARCH AND TECHNOLOGY LABORATORIES (AVRADCOM)
Fort Eustis, Va. 23604

APPLIED TECHNOLOGY LABORATORY POSITION STATEMENT

In 1975 a wind tunnel test program was conducted in the Boeing-Vertol 20-foot V/STOL Wind Tunnel on a 1/5th-scale UTTAS model to investigate and find solutions for several aerodynamic problems encountered during the UTTAS flight-testing. Specifically, these tests focused upon (a) the structure of the hub/rotor wake in the vicinity of the empennage, (b) the formulation of the ground vortex and its relation to hub loads and fuselage loads during transition, and (c) the occurrence of vibratory air pressures from the blade passing over the fuselage. Only portions of the above-mentioned wind tunnel test data were reduced and analyzed in addressing the flight-test problems of the UTTAS aircraft.

Under Contract DAAJ02-77-C-0020, Boeing-Vertol completed analyses on the data to understand more completely the aerodynamic interactions that are involved and to formulate instructions for the guidance of designers in these respects. The results of these studies are applicable to all existing and future single-rotor/tail rotor helicopters. The data have been segregated according to aerodynamic interactions and associated phenomena/problem areas. From this body of knowledge, a generalized set of design guidelines meaningful to the single-rotor helicopter design concept formulation were developed and are included in these reports.

Mr. Robert P. Smith of the Aeronautical Technology Division, Aeromechanics Technical Area, served as project engineer for this effort.

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

(19) REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

(18) 1. REPORT NUMBER: USARTL-TR-78-23H-1 | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER

(6) 4. TITLE (and Subtitle): INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. Volume VIII. Frequency Analyses of Wake Single Film Data, [redacted] Buildup to Baseline.

(9) 5. TYPE OF REPORT & PERIOD COVERED: FINAL REPORT 15 Mar 1977 — 13 Feb 1978

6. PERFORMING ORG. REPORT NUMBER

(10) 7. AUTHOR(s): Philip F. Sheridan (-A)

(15) 8. CONTRACT OR GRANT NUMBER(s): DAAJ02-77-C-0020

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Boeing Vertol Company
P.O. Box #16858
Philadelphia, Pa. 19142

(16) (17) 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 62209A 1L262209AH76 00189 EK

11. CONTROLLING OFFICE NAME AND ADDRESS
Applied Technology Laboratory, US Army Research and Technology Laboratories (AVRADCOM)
Fort Eustis, Virginia 23604

(11) 12. REPORT DATE: Sep[redacted] 78

13. NUMBER OF PAGES: 290

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)
(12) 291 p.

15. SECURITY CLASS. (of this report): Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES
Volume VIII of an eight-volume report
Volume VIII is comprised of three sub-volumes (A thru C)

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Wake	Interaction	Empennage
Flow	Aerodynamic Interaction	Flow Modifier
Frequency	Flow Environment	Powered Model
Spectrum	Configuration	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This is the first of the three volumes of Volume VIII containing frequency spectrographs of the model helicopter hub/rotor wake velocities derived from the single-film velocity transducer data. This sub-volume deals with the wake changes as the model is built up to the baseline configuration.

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PREFACE

The entire report describing the investigation of INTERACTIONAL AERODYNAMICS OF THE SINGLE-ROTOR HELICOPTER CONFIGURATION comprises eight numbered volumes bound as 33 separate documents. The complete list of these documents is as follows:

Volume I, Final Report

Volume II, Harmonic Analyses of Airframe Surface Pressure Data
- A – Runs 7-14, Forward Section
- B – Runs 7-14, Mid Section
- C – Runs 7-14, Aft Section
- D – Runs 15-22, Forward Section
- E – Runs 15-22, Mid Section
- F – Runs 15-22, Aft Section
- G – Runs 23-33, Forward Section
- H – Runs 23-33, Mid Section
- I – Runs 23-33, Aft Section

Volume III, Flow Angle and Velocity Wake Profiles in Low-Frequency Band
- A – Basic Investigations and Hubcap Variations
- B – Air Ejector Systems and Other Devices

Volume IV, One-Third Octave Band Spectrograms of Wake Split-Film Data
- A – Buildup to Baseline
- B – Basic Configuration Wake Explorations
- C – Solid Hubcaps
- D – Open Hubcaps
- E – Air Ejectors
- F – Air Ejectors With Hubcaps; Wings
- G – Fairings and Surface Devices

Volume V, Harmonic Analyses of Hub Wake

Volume VI, One-Third Octave Band Spectrograms of Wake Single Film Data
- A – Buildup to Baseline
- B – Basic Configuration Wake Exploration
- C – Hubcaps and Air Ejectors

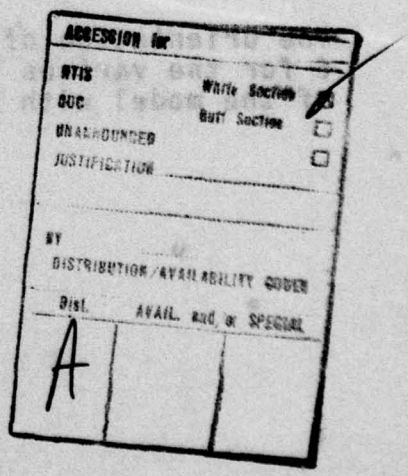
Volume VII, Frequency Analyses of Wake Split-Film Data
- A – Buildup to Baseline
- B – Basic Configuration Wake Explorations
- C – Solid Hubcaps

D — Open Hubcaps
E — Air Ejectors
F — Air Ejectors With Hubcaps; Wings
G — Fairings and Surface Devices

Volume VIII, Frequency Analyses of Wake Single Film Data

A — Buildup to Baseline
B — Basic Configuration Wake Exploration
C — Hubcaps and Air Ejectors

TABLE OF CONTENTS



INTRODUCTION

Volume VIII is similar in its format to Volume VII, presenting machine plotted spectrograms. Here the velocity data from the single film outboard transducers is considered in contrast to the split film data of Volume VII which gave flow angle information as well as velocity. The data analysis here was conducted for a limited number of test runs as it is of secondary interest. The runs are the same as for the harmonic analysis of Volume V.

The sub-volumes of Volume VIII display data derived from the following test runs:

Volume VIII-A - 149, 150, 160, 156, 158, 159
Volume VIII-B - 111 -119, 121, 135, 136
Volume VIII-C - 188, 211, 168, 167, 194, 161, 154, 172, 174, 176, 203, 205, 197

These runs follow the order of the logical arrangement of the Outline of Wake Investigations, Table 1, from which they have been selected. The Table I outline and other material is included for reference and as context to the work of each sub-volume. Table 2, the List of Test Runs, arranges the runs in numerical order and gives pertinent text parameters.

The Index of Rake Positions, Table 3, lists the hot film transducer rake positions in the model coordinate system for each run and its test points. The main feature of Table 3 is the indexing of the test point number to the model water line station and butt line as it varied from run to run. The table groups the runs as they shared the indexing correspondence of point with position. It is emphasized that the runs in a group do not necessarily all share the same number of test points but they do have same correspondence within their respective ranges of test points.

The orientation of rake is shown pictorially in Figures 1 through 6 for the various test runs. Figure 7 presents a scaled drawing of the model with reference to the three-axis coordinate system.

TABLE 1

OUTLINE OF WAKE INVESTIGATIONS

Description	Configuration Code	Run No.	Base-line
Build-up to Baseline			
1. Nacelles removed	$K_{13}+H_1-N$	149	150
2. Blades off, rotating hub	$K_{13}-M+H_{1.0}$	160	156
3. " " , non-rotating hub	$K_{13}-M+H_{1.0}$	158	156
4. " " , hub off	$K_{13}-M-H_{1.0}$	159	156
Basic Configuration			
1. Wake Explorations near Empennage			
(a) 15" Long. + traverse at T/R C.L.	K_{11}	111	---
(b) 9" Vert. + " above T/R "	"	112	---
(c) 2" " " in vortex	"	113	---
(d) 8" " " (continue 112)	"	114	---
(e) 13" " " behind stab.	"	115	---
(f) Lateral traverse, left stab. (One T.P. only)	"	116	---
(g) Same continued	"	117	---
(h) Same continued (One T.P. only)	"	118	---
(i) Lateral traverse right stab.	"	119	---
(j) T/R effect on wake	$K_{11}+T_2^0$	121	115
2. Climb/Descent Studies			
(a) Climb 900 FPM	K_{11}	135	---
(b) Descent 800 FPM	"	136	---
Effect Of Hub Caps			
1. Solid Caps on Canister			
(a) 7.6" diam. 2.17" ht. soft Pitch Arms	$K_{11}-H_{1.0}+H_{1.2}$	137	136
(b) 7.6" diam. 2.17" ht. stiff Pitch Arms	$K_{13}+H_{1.2}$	153	156
(b) 7.6" diam. 2.45" ht. flt. test config.	$K_{13}+H_{1.2.1}+I_1+E_{1.0}$	207	188

TABLE 1 (CONTINUED)

OUTLINE OF WAKE INVESTIGATIONS

Description	Configuration Code*	Run No.	Base-line
Effect of Hub Caps (Continued)			
2. Solid Caps Raised Above Canister			
(a) 7.6" diam. 2.45" ht. 70" depth, .55 gap	$H_{1.2.2}+I_1+E_{1.0}$	208	188
(b) 10.0" diam. 3.25" ht. 1.55" depth, .50" gap	$H_{1.8.1}+I_1+E_{1.0}$	189	188
(c) 10.0" diam. 4.125" ht. 2.05" depth, .875" gap	$H_{1.8.2}+I_1+E_{1.0}$	190	188
(d) Repeat of 189	" " "	210	188
3. Open Caps Without Underbody			
(a) 10.0" diam. 1.25" gap,blades	$H_{1.0.2}+I_1+E_{1.0}$	193	188/166
(b) " " " gap, no blades	$H_{1.0.1}-M$	166	158
(c) " " 2.05" gap,blades	$H_{1.14.1}+I_1+E_{1.0}$	211	188
(d) " " 1.75" gap, no blades	$H_{1.0.1}-M$	165	158
(e) " " 1.87" gap,blades	$H_{1.0.3}+I_1+E_{1.0}$	191	188
(f) 16" diam. 2.00" gap,blades	$H_{1.7.1}$	168	156/167
(g) " " " gap, no blades	$H_{1.7.1}-M$	167	158
(h) " " 4.00" gap,blades	$H_{1.7.2}$	169	156
4. Open Caps with Underbody			
(a) 7.6" diam. 1.25" gap	$H_{1.11.1}+I_2+E_{1.0}$	194	188
(b) " " " "	$H_{1.11.1}+I_2+E_{4.0}$	198	188
(c) " " " " center post	$H_{1.11.2}+I_2$	202	194
(d) 10.0" diam. .5" gap, no blades	$H_{1.5.1}-M$	164	158
(e) " " 1.25" gap, no blades	$H_{1.5.2}-M$	161	158
(f) " " 2.0" gap, no blades	$H_{1.5.4}-M$	163	158
(g) " " 4.0" gap, no blades	$H_{1.5.3}-M$	162	158
(h) " " 1.25" gap	$H_{1.5.2}$	154	156/161

*Basic Code is K13.

TABLE 1 (CONTINUED)

OUTLINE OF WAKE INVESTIGATIONS

Description	Configuration Code*	Run No.	Base-line
5. Miscellaneous Hub Covers			
(a) Hub fairing 16" diam.	$H_{1.3}$	151	150
(b) Wham-O-Frisbee 10" diam.	$H_{1.9.0}+E_{1.2}$	182	181
(c) Fab. glass Frisbee 16" diam.	$H_{1.9.1}+E_{1.2}$	183	181
Effect of Air Ejectors			
1. Basic system no blowing	$H_{1.0}+E_{1.0}$	172	156
2. " " 40 psi	" "	173	156/172
3. " " 150 psi	" "	174	156/172
4. Wide chord shroud 40 psi	$H_{1.0}+E_{2.5.1}$	175	156/173
5. Wide " " 150 psi	" "	176	156/174
6. W/C shroud w. lip 40 psi	$H_{1.0}+E_{3.5.2}$	184	156/173
7. Same Contoured Parallel 150 psi	$H_{1.0}+E_{3.5.4}$	187	156/174
8. Bifurcated duct 0 psi	$H_{1.0}+E_{5.0}$	203	156
9. " " 40 psi	" "	204	156/203
10. " " 150 psi	" "	205	156/203
Air Ejectors with Open Hub Caps with Underbodies			
1. 7.6" diam. 1.25" gap, 0 psi	$H_{1.11.1}+I_2+E_{1.0}$	194	188/172
2. " " " " 20 psi	" " "	195	188
3. " " " " 40 psi	" " "	196	188/173
4. " " " " 150 psi	" " "	197	188/174
5. " " " " 0 psi	$H_{1.11.1}+I_2+E_{4.0}$	198	188/194
6. " " " " 40 psi	" " "	199	188/196
7. " " " " 150 psi	" " "	200	188/196
8. Same with center post	$H_{1.11.2}+I_2+E_{4.6}$	201	188/200
9. 10.0" diam. 2.0" gap wide ch'd. shroud (150 psi)	$H_{1.5.4}+E_{2.5.1}$	177	156/176
Effect of Wings and Misc.			
1. Wings			
(a) Nacelle-mounted stub wing	$H_{1.0}+W_{1.0}+E_{1.1}$	178	181
(b) Single slotted flapped wing	$H_{1.0}+W_{3.0}+E_{1.0}$	180	181
(c) Dougle slotted flapped wing	$H_{1.0}+W_{2.0}+E_{1.0}$	179	181
(d) Boom-mounted stub wing	$H_{1.0}+W_{4.0}$	186	156

*Basic Code is K13.

TABLE 1 (CONTINUED)

OUTLINE OF WAKE INVESTIGATIONS

Description	Configuration Code*	Run No.	Base-line
2. Crown Fairings			
(a) Flat top behind shaft	$K_{11}+D_1$	140	138
(b) Round top behind shaft	$K_{11}+D_2$	141	138
(c) Extended flat top fairing	H_1+D_4	170	156
(d) Flat top + 16" cap, 4" gap	$H_{1.7.2}+D_4$	171	170
(e) Forward fairing/nacelle fairing	$P_{1.0}$	152	156
3. Surface Devices			
(a) Vortex generators	$K_{11}+VG_{2.1}$	139	138
(b) Guidevane between nacelles	$K_{11}+FV_1$	142	138
(c) Longitudinal strakes	$H_{1.5.3}+S_4$	155	156
(d) 14% porosity spoiler	$K_{11}+X_1$	143	138

*Basic Code is K13 unless noted otherwise.

TABLE 2. **LIST OF TEST RUNS**
BASIC INVESTIGATIONS OF THE HUB WAKE

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					α°	ψ°	h/d	
111	K_{11}/15" Long. wake traverse at TR center line	80	1433/0	8	6.0	-2.0	∞	Off
112	" /9" Vert. wake traverse above TR center line	"	"	"	"	"	"	"
113	" /2" Vert traverse through MR vortex	"	"	"	"	"	"	"
114	" /8" Vert. traverse below TR center line	"	"	"	"	"	"	"
115	" /13" Vert. traverse behind stabilizer	"	"	"	"	"	"	"
116	" /Lateral traverse - left stabilizer	"	"	"	"	"	"	"
117	" /116 continued	"	"	"	"	"	"	"
118	" /116 continued	"	"	"	"	"	"	"
119	" /Lateral traverse - right stabilizer	"	"	"	"	"	"	"
121	$K_{11}+T_2$/Effect of tail rotor flow on wake	"	1433/ 4500	"	"	"	"	On
135	K_{11}/Wake in 900 fpm climb	"	"	"	-6.0	-4.5	"	Off
136	" /Wake in 800 fpm descent	"	"	"	6.0	-2.0	"	"

TABLE 2 (CONTINUED) **LIST OF TEST RUNS**
EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					$\alpha°$	$\psi°$	h/d	
137	K_{11}-$H_{1.0}$+$H_{1.2}$/Effect of 7.6 inch diam. solid hub cap	80	1433/0	8	6	-3.8	∞	Off
138	K_{11}/Repeat of base run	"	"	"	"	"	"	"
139	K_{11}+$VG_{2.1}$/Effect of vortex generators on aft crown	"	"	"	"	"	"	"
140	K_{11}+D_1/Flat-topped "doghouse" fairing on aft crown	"	"	"	"	"	"	"
141	K_{11}+D_2/Rounded-top fairing	"	"	"	"	"	"	"
142	K_{11}+FV_1/Deflection vane on crown between nacelles	"	"	"	"	"	"	"
143	K_{11}+X_1/Variable porosity spoiler	"	"	"	"	"	"	"
149	K_{13}+H_1-N_1/Effect of nacelles off also add stiff pitch arms (K_{13})	60	1075/0	4.5	"	"	"	"
150	K_{13}+H_1/60 knot baseline	"	"	"	"	"	"	"
151	K_{13}+$H_{1.3}$/16 inch diam. helmet fairing	"	"	"	"	"	"	"
152	K_{13}+$P_{1.0}$/Pylon and intake fairings	80	1433/0	8	"	"	"	"
153	K_{13}+$H_{1.2}$/Repeat 137 with K_{13} pitch arms	"	"	"	"	"	"	"

TABLE 2 (CONTINUED) LIST OF TEST RUNS

EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					α°	ψ°	h/d	
154	$K_{13}+H_{1.5.2}$/10" open hub cap, 7" underbody, 1.25"gap	80	1433/0	8	6	-3.8	∞	Off
155	$K_{13}+H_{1.5.2}+S_4$/Same as 154 except strakes on aft crown	"	"	"	"	"	"	"
156	$K_{13}+H_{1.0}$/Baseline with K_{13},i.e., stiff pitch arms	"	"	"	"	"	"	"
158	$K_{13}-M+H_{1.0}$/Wake studies with blades off, hub not rotating	"	0/0	"	"	"	"	"
159	$K_{13}-M-H_{1.0}$/Wake studies with hub off	"	"	"	"	"	"	"
160	$K_{13}-M+H_{1.0}$/Same as 158 except hub is rotating	"	1433/0	"	"	"	"	"
161	$K_{13}-M+H_{1.5.2}$/Repeat of 154 without blades	"	0/0	"	"	"	"	"
162	$K_{13}-M+H_{1.5.3}$/Same as 161 except 4" gap	"	"	"	"	"	"	"
163	$K_{13}-M+H_{1.5.4}$/Same as 161 except 2" gap	"	"	"	"	"	"	"
164	$K_{13}-M+H_{1.5.1}$/Same as 161 except 0.5" gap	"	"	"	"	"	"	"
165	$K_{13}-M+H_{1.0.1}$/ 10" open hub cap,no underbody,same cap vert.position as Run 154	"	"	"	"	"	"	"
166	$K_{13}-M+H_{1.0.2}$/Same as 165 with cap lowered by 0.5"	"	"	"	"	"	"	"

TABLE 2 (CONTINUED) **LIST OF TEST RUNS**
EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					$\alpha°$	$\psi°$	h/d	
167	K_{13}-M+$H_{1.7.1}$/16" open cap, no underbody, 2" gap	80	0/0	8	6	-3.8	∞	Off
168	K_{13}+$H_{1.7.1}$/Blades on, same cap config. as 167	"	1433/0	"	"	"	"	"
169	K_{13}+$H_{1.7.2}$/16" open cap, no underbody, 4" gap	"	"	"	"	"	"	"
170	K_{13}+$H_{1.0}$+$D_{4.0}$/Extended flat top fairing on aft crown	"	"	"	"	"	"	"
171	K_{13}+$H_{1.7.2}$+$D_{4.0}$/Same fairing as 170 same cap as 169	"	"	"	"	"	"	"
172	K_{13}+$H_{1.0}$+$E_{1.0}$(0psi)/Basic air ejector zero blowing baseline	"	"	"	"	"	"	"
173	K_{13}+$H_{1.0}$+$E_{1.0}$(40 psi)/Same as 172 with 40 psi supply	"	"	"	"	"	"	"
174	K_{13}+$H_{1.0}$+$E_{1.0}$(150 psi)/Same as 172 with 150 psi supply	"	"	"	"	"	"	"
175	K_{13}+$H_{1.0}$+$E_{2.5.1}$(40 psi)/Ejector with wide chord shroud at 40 psi	"	"	"	"	"	"	"
176	K_{13}+$H_{1.0}$+$E_{2.5.1}$(150 psi)/Same as 174 with 150 psi supply	"	"	"	"	"	"	"
177	K_{13}+$H_{1.5.4}$+$E_{2.5.1}$(150 psi)/Same as 176 with 10" cap like 163	"	"	"	"	"	"	"
178	K_{13}+$H_{1.0}$+$W_{1.0}$+$E_{1.1}$(0 psi)/Nacelle mounted wing	"	"	"	"	"	"	"

TABLE 2 (CONTINUED) **LIST OF TEST RUNS**

EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					α°	ψ°	h/d	
179	$K_{13}+H_{1.0}+W_{2.0}+E_{1.0}$ (0 psi)/Double slotted flapped wing	80	1433/0	8	6	-3.8	∞	Off
180	$K_{13}+H_{1.0}+W_{3.0}+E_{1.0}$ (0 psi)/Single slotted flapped wing	"	"	"	"	"	"	"
181	$K_{13}+H_{1.0}+E_{1.2}$ (0 psi)/Baseline with ejector tube moved aft	"	"	"	"	"	"	"
182	$K_{13}+H_{1.9.0}+E_{1.2}$ (0 psi)/Standard 10" frisbee	"	"	"	"	"	"	"
183	$K_{13}+H_{1.9.1}+E_{1.2}$ (0 psi)/16" fabricated frisbee	"	"	"	"	"	"	"
184	$K_{13}+H_{1.0}+E_{3.5.2}$ (40 psi)/Wide chord with lip at 40 psi	"	"	"	"	"	"	"
185	$K_{13}+H_{1.0}+E_{3.5.2}$ (150 psi)/Same as 184 with 150 psi air	"	"	"	"	"	"	"
186	$K_{13}+H_{1.0}+W_{4.0}$/Boom mounted stub wing	"	"	"	"	"	"	"
187	$K_{13}+H_{1.0}+E_{3.5.4}$ (150 psi)/Like 185 with modified shroud	"	"	"	"	"	"	"
188	$K_{13}+H_{1.0}+I_1+E_{1.0}$ (0 psi)/Baseline with I_1 instr. ring	"	"	"	"	"	"	"
189	$K_{13}+H_{1.8.1}+I_1+E_{1.0}$ (0 psi)/Solid cap, 10" diam. 3.25" height	"	"	"	"	"	"	"
190	$K_{13}+H_{1.8.2}+I_1+E_{1.0}$ (0 psi)/Same as 190 except + 4.12" height	"	"	"	"	"	"	"

TABLE 2 (CONTINUED) **LIST OF TEST RUNS**

EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					$\alpha°$	$\psi°$	h/d	
191	$K_{13}+H_{1.0.2}+I_1+E_{1.0}$ (0 psi)/10" cap, no underbody, 1.87" gap	80	1433/0	8	6	-3.8	∞	Off
193	$K_{13}+H_{1.0.2}+I_1+E_{1.0}$ (0 psi)/10" cap, no underbody, 1.25" gap	"	"	"	"	"	"	"
194	$K_{13}+H_{1.11.1}+I_2+E_{1.0}$(0 psi)/7.6" cap, underbody, 1.25" gap	"	"	"	"	"	"	"
195	$K_{13}+H_{1.11.1}+I_2+E_{1.0}$(20 psi)/Same as 194 with 20 psi air	"	"	"	"	"	"	"
196	$K_{13}+H_{1.11.1}+I_2+E_{1.0}$(40 psi)/Same as 194 with 40 psi air	"	"	"	"	"	"	"
197	$K_{13}+H_{1.11.1}+I_2+E_{1.0}$(150 psi)/Same as 194 with 150 psi air	"	"	"	"	"	"	"
198	$K_{13}+H_{1.11.1}+I_2+E_{4.0}$ (0 psi)/Same as 194 except blowing tube 2" aft	"	"	"	"	"	"	"
199	$K_{13}+H_{1.11.1}+I_2+E_{4.0}$ (40 psi)/Same as 198 with 40 psi air	"	"	"	"	"	"	"
200	$K_{13}+H_{1.11.1}+I_2+E_{4.0}$ (150 psi)/Same as 198 with 150 psi air	"	"	"	"	"	"	"
201	$K_{13}+H_{1.11.2}+I_2+E_{4.0}$ (150 psi)/Same as 200 except center support cap	"	"	"	"	"	"	"
202	$K_{13}+H_{1.11.2}+I_2$/Baseline with I_2 and no blowing tube	"	"	"	"	"	"	"
203	$K_{13}+H_{1.0}+E_{5.0}$(0 psi)/Bifurcated air duct baseline	"	"	"	"	"	"	"

TABLE 2 (CONTINUED) **LIST OF TEST RUNS**
EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					α°	ψ°	h/d	
204	$K_{13}+H_{1.0}+E_{5.0}$ (150 psi)/Bifurcated duct with 150 psi air	80	1433/0	8	6	-3.8	∞	Off
205	$K_{13}+H_{1.0}+E_{5.0}$ (40 psi)/Same as 204 with 40 psi air	"	"	"	"	"	"	"
207	$K_{13}+H_{1.2.1}+I_1+E_{1.0}$ (0 psi)/7.6" solid cap, no gap	"	"	"	"	"	"	"
208	$K_{13}+H_{1.2.2}+I_1+E_{1.0}$ (0 psi)/Same as 207 except 0.55" gap	"	"	"	"	"	"	"
210	$K_{13}+H_{1.15.1}+I_1+E_{1.0}$ (0 psi)/Repeat of 189	"	"	"	"	"	"	"
211	$K_{13}+H_{1.14.1}+I_1+E_{1.0}$ (0 psi)/Like 189 and 210 except cap is open	"	"	"	"	"	"	"

TABLE 3

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
111	20	53.5	103.1	-7.25	1
	21	"	"	"	
	22	"	105.0	"	
	24	"	107.0	"	
	26	"	109.0	"	
	28	"	111.0	"	
	30	"	112.9	"	
	32	"	114.9	"	
	34	"	116.9	"	
	36	"	118.9	"	
112	2	48.9	107.3	-7.25	1
	4	50.8	"	"	
	6	52.7	103.3	"	
	8	54.5	"	"	
	10	56.2	"	"	
	12	57.2	"	"	
113	2	51.7	103.3	-3.25	1
	4	52.3	"	"	
	6	52.8	"	"	
	8	53.3	"	"	
	10	53.9	"	"	
	11	53.3	"	"	
114	2	44.5	103.0	-3.25	1
	4	46.4	"	"	
	6	48.2	"	"	
	8	50.0	"	"	
	10	51.9	"	"	
115	3	52.9	124.7	-3.25	1
	4	52.0	"	"	
	6	50.0	"	"	
	9	48.0	"	"	
	10	46.0	"	"	
	12	44.1	"	"	
	14	42.1	"	"	
	16	53.0	"	"	
	18	54.0	"	"	
	20	55.0	"	"	

TABLE 3 (CONTINUED)

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
116	7	36.9	100.5	-17.5	1
117	2	37.6	100.5	-16.0	1
	4	"	"	-14.0	
	6	37.3	99.6	-12.0	
	8	"	"	-10.0	
	10	"	"	- 8.0	
118	2	37.6	100.5	- 6.0	1
119	2	37.3	99.6	+ 6.0	1
	5	"	"	8	
	8	"	"	10	
	9	"	"	"	
	14	"	"	14	
	16	"	"	16	
	20	51.5	102.5	17.5	
	25	52.3	101.7	-17.5	
121	3	62.9	129.0	+ 5.7	2
	4	53.5	"	"	
	6	50.1	"	"	
	8	46.0	"	"	
	10	42.1	"	"	
135	2	56.9	106.3	- 5.7	3
	4	54.5	"	"	
	6	52.5	"	"	
	8	50.5	"	"	
	10	48.5	"	"	
	12	46.5	"	"	
	14	44.5	"	"	
136	2	56.5	104.0	- 8.0	4
	4	54.5	"	"	
	6	52.5	"	"	
	8	50.6	"	"	
	10	48.5	"	"	
	12	46.5	"	"	
	14	44.5	"	"	
	17	37.1	"	"	
	18	39.0	"	"	
	19	41.0	"	"	

TABLE 3 (CONTINUED)

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
137	3	38.7	98.4	- 8.0	5
	5	39.9	"	"	
	7	42.0	100.5	"	
	9	44.0	"	"	
	11	46.0	103.6	"	
	13	48.0	"	"	
	15	50.0	"	"	
	17	52.0	"	"	
	19	54.0	"	"	
138-41, 143	2	38.8	98.4	- 8.0	5
	3	40.0	"	"	
	4	42.0	100.5	"	
	5	44.0	"	"	
	6	46.0	103.6	"	
	7	48.0	"	"	
	8	50.0	"	"	
	9	52.0	"	"	
	10	54.0	"	"	
142	7	37.8	98.4	- 8.0	5
	8	"	"	"	
	9	40.2	"	"	
	10	42.0	100.5	"	
	11	44.0	"	"	
	12	46.0	103.6	"	
	13	48.0	"	"	
	14	50.0	"	"	
	15	52.0	"	"	
	16	54.0	"	"	
	17	56.8	"	"	

TABLE 3 (CONTINUED)

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
149-151	2	38.8	98.5	- 8.0	5
	3	40.0	"	"	
	4	42.0	100.6	"	
	5	44.0	"	"	
	6	46.0	103.5	"	
	7	48.0	"	"	
	8	50.0	"	"	
	9	52.0	"	"	
	10	54.0	"	"	
152-6, 158 161-4, 166 167, 169-71 175, 177-9 180,182,184 186-8, 190 191,193,194 196,198,201 204,207,208 211	2	42.9	97.9	0.0	6
	3	44.9	"	"	
	4	46.9	100.6	"	
	5	48.9	"	"	
	6	50.9	104.6	"	
	7	52.9	"	"	
	8	54.9	"	"	
	9	56.9	"	"	
159	1	54.9	104.6	0.0	6
	2	52.9	"	"	
	3	50.7	"	"	
	4	48.6	100.6	"	
	5	46.7	"	"	
160,203	5	42.9	97.9	0.0	6
	6	44.9	"	"	
	7	46.9	100.6	"	
	8	48.9	"	"	
	9	50.9	104.6	"	
	10	52.9	"	"	
	11	54.9	"	"	
165	3	44.9	97.9	0.0	6
	4	42.9	"	"	
	5	46.9	100.6	"	
	6	48.9	"	"	
	7	50.9	104.6	"	
	8	52.9	"	"	

TABLE 3 (CONTINUED)

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
168, 183	4	42.9	97.9	0.0	6
	5	44.9	"	"	
	6	46.9	100.6	"	
	7	48.9	"	"	
	8	50.9	104.6	"	
	9	52.9	"	"	
	10	54.9	"	"	
172	3	42.9	97.9	0.0	6
	4	44.9	"	"	
	6	44.9	"	"	
	7	46.9	100.6	"	
	8	48.9	"	"	
	9	50.9	104.6	"	
	10	52.9	"	"	
	11	54.9	"	"	
173,174,176	1	42.9	97.9	0.0	6
185,195,197	2	44.9	"	"	
199,200,205	3	46.9	100.6	"	
210	4	48.9	"	"	
	5	50.9	104.6	"	
	6	52.9	"	"	
	7	54.9	"	"	
181	2	42.9	97.9	0.0	6
	3	44.9	"	"	
	4	46.9	100.6	"	
	5	48.9	"	"	
	6	50.9	104.6	"	
	7	52.9	"	"	
	9	54.9	"	"	
	10	"	"	"	
	11	"	"	"	
	12	"	"	"	
	13	42.9	97.9	"	

TABLE 3 (CONTINUED)

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
189	29	42.9	97.9	0.0	6
	30	44.9	"	"	
	31	46.9	100.6	"	
	32	48.9	"	"	
	33	"	"	"	
	34	50.9	104.6	"	
	35	"	"	"	
	36	48.9	100.6	"	
	37	50.9	104.6	"	
	38	52.9	"	"	
	39	54.9	"	"	
202	3	43.4	97.9	0.0	6
	4	44.9	"	"	
	5	46.9	100.6	"	
	6	48.9	"	"	
	7	50.9	104.6	"	

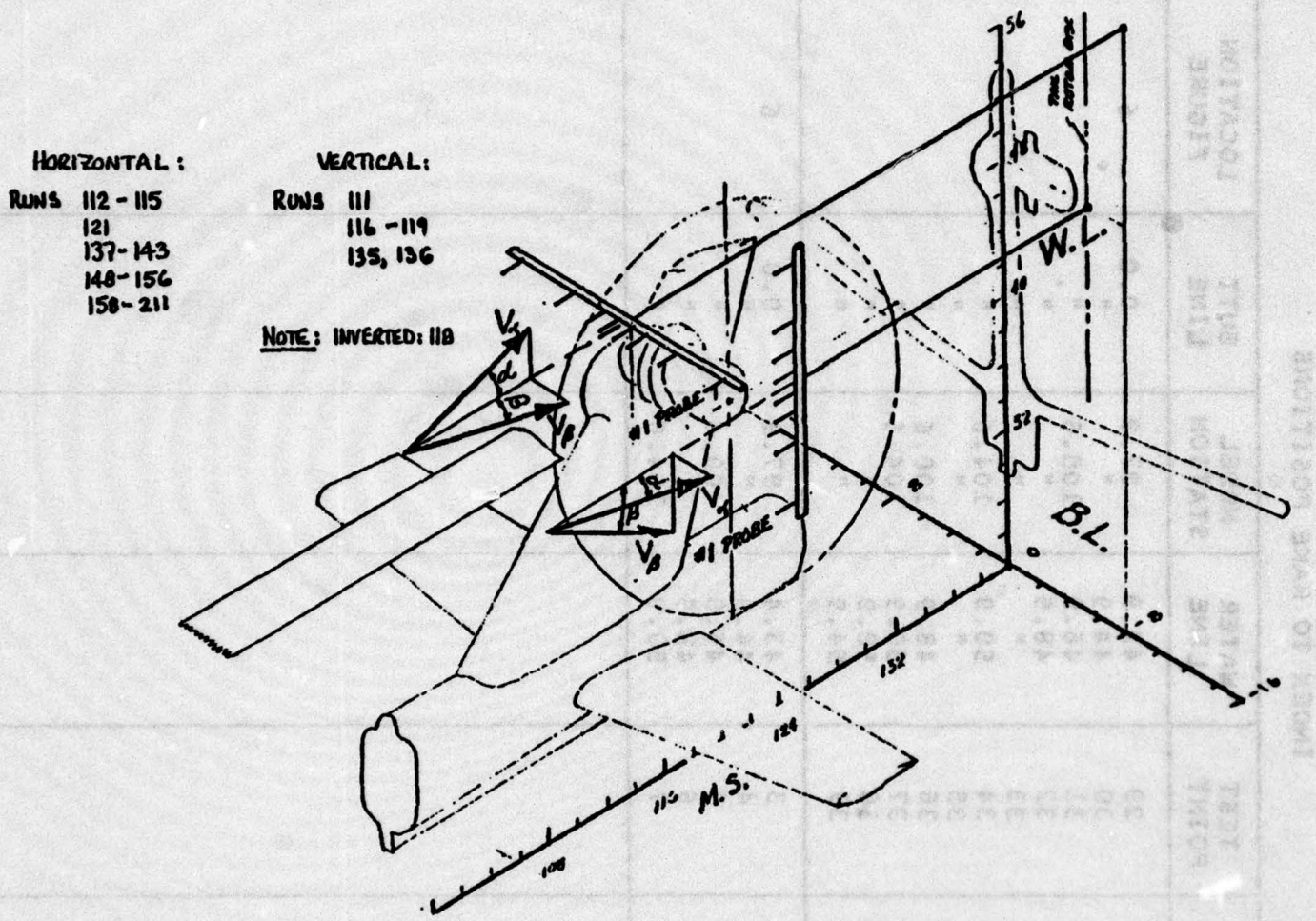


FIGURE 1 - RAKE ORIENTATION DIAGRAM

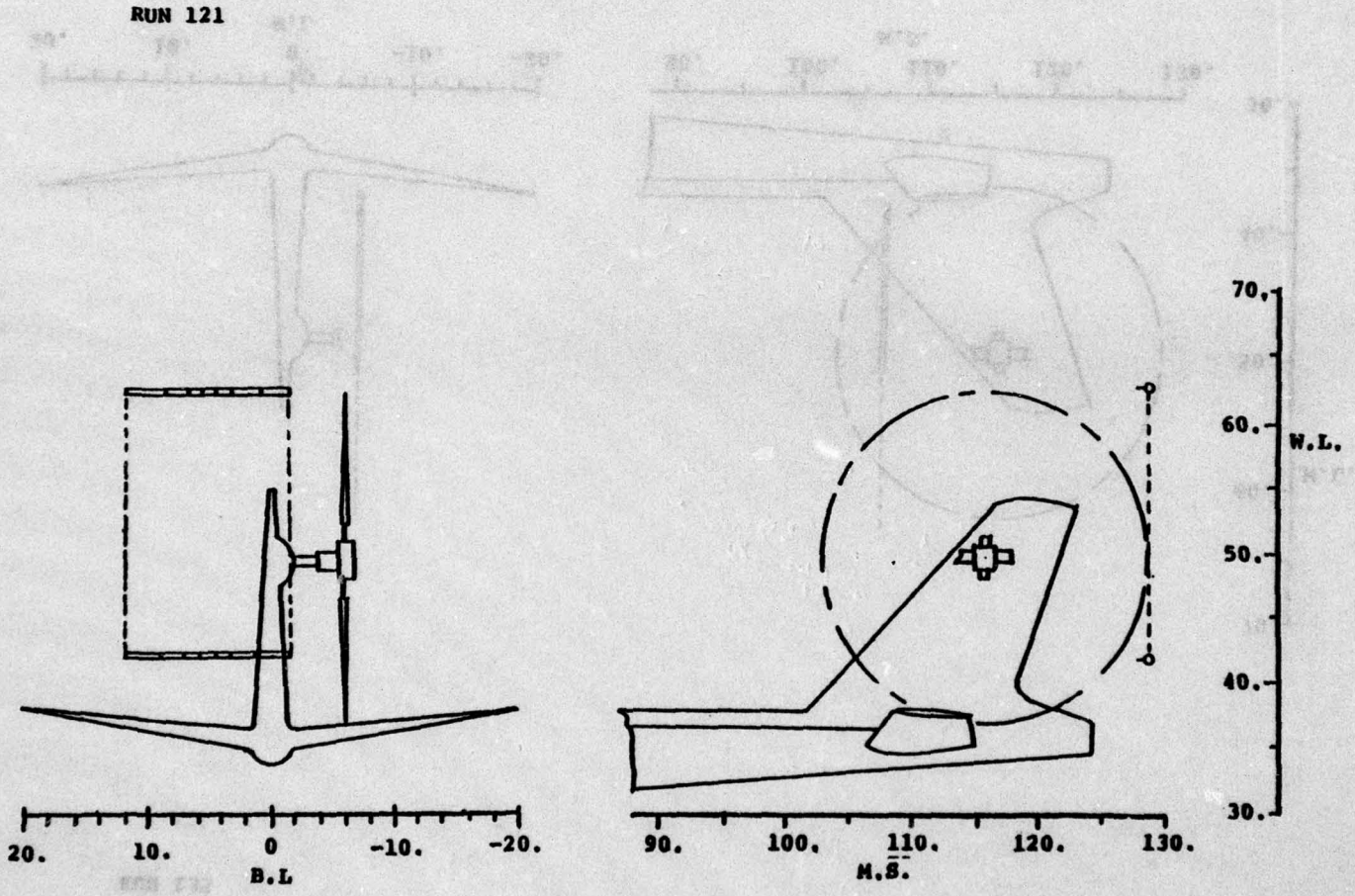


FIGURE 2 -HOT FILM RAKE LOCATIONS

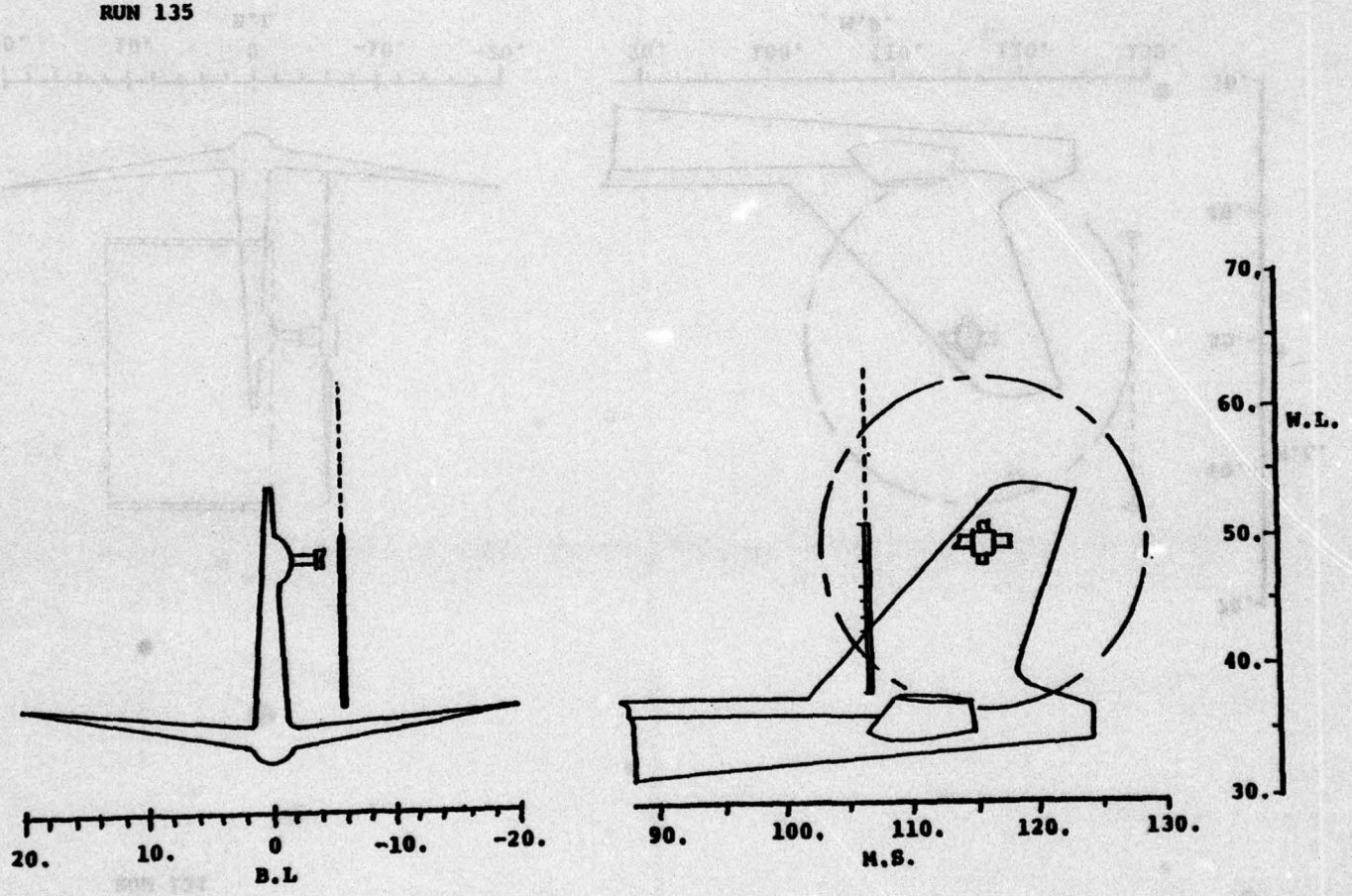


FIGURE 3 -HOT FILM RAKE LOCATIONS

RUN 136

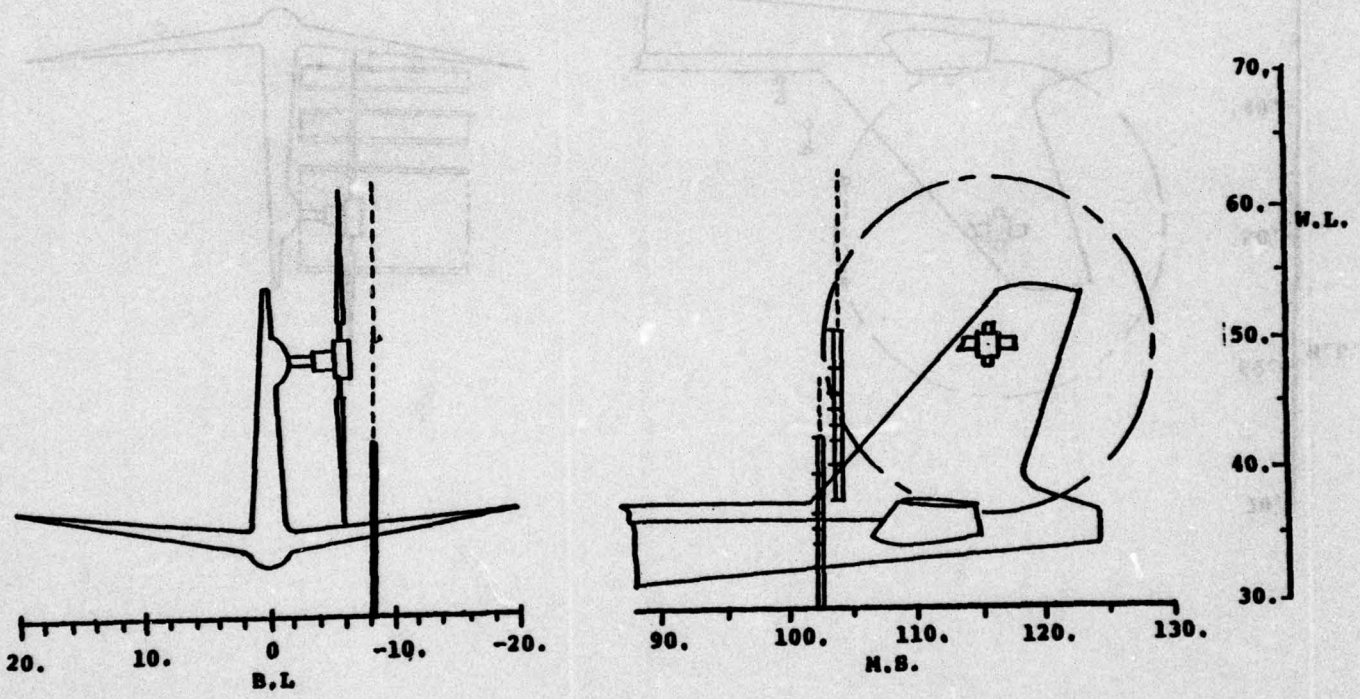


FIGURE 4 -HOT FILM RAKE LOCATIONS

RUN 137, 138, 139, 140, 141, 142,
143, 148, 149, 150, 151

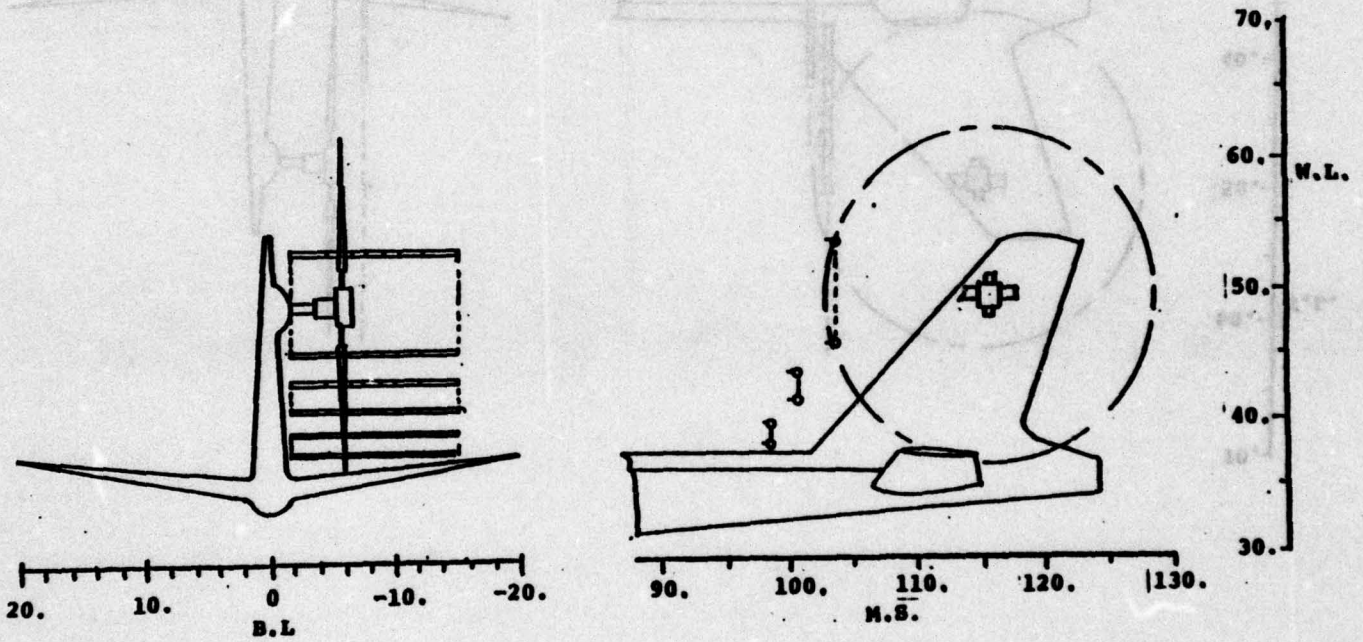


FIGURE 5 -HOT FILM RAKE LOCATIONS

RUN 152-156, 158-211

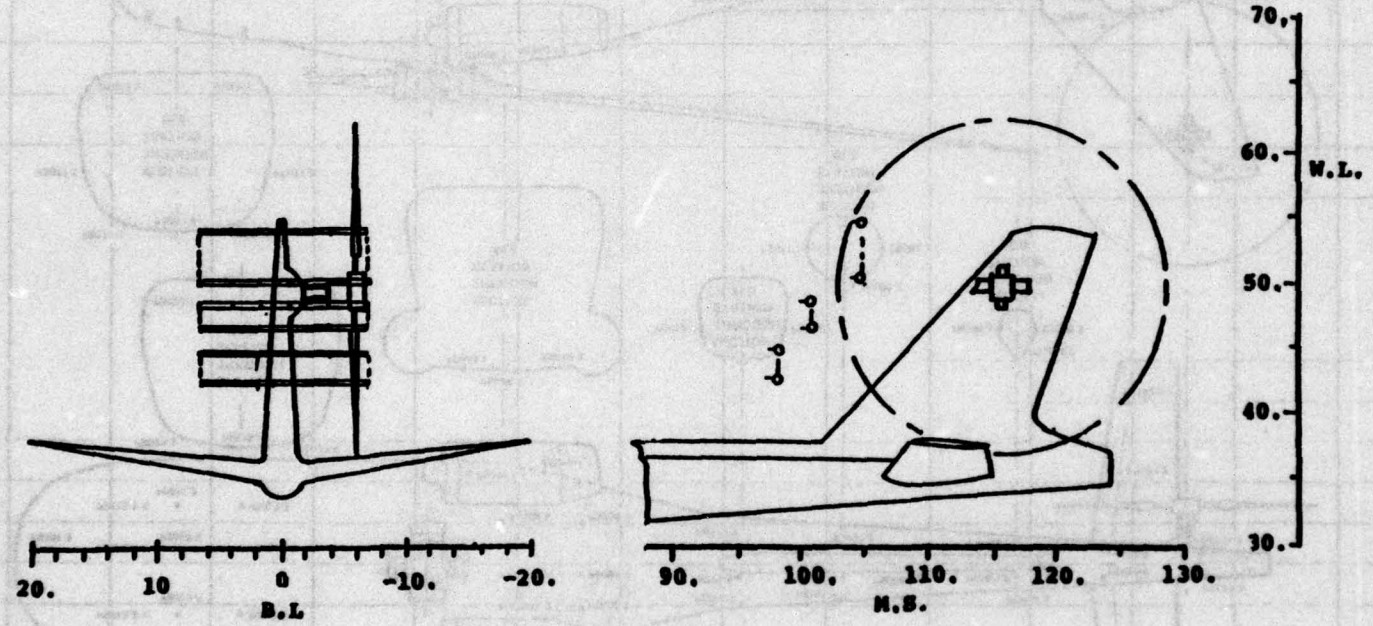


FIGURE 6 -HOT FILM RAKE LOCATIONS

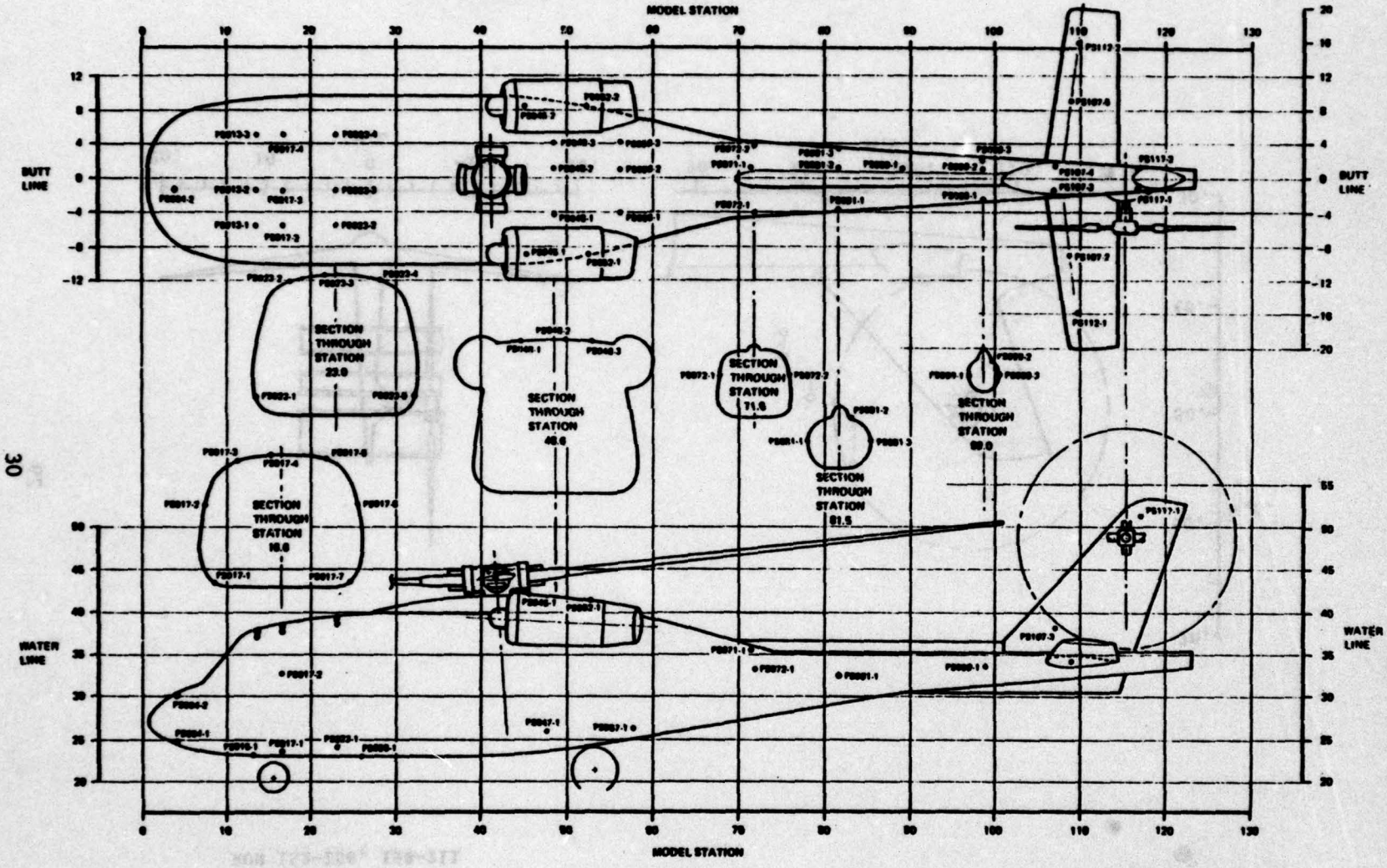
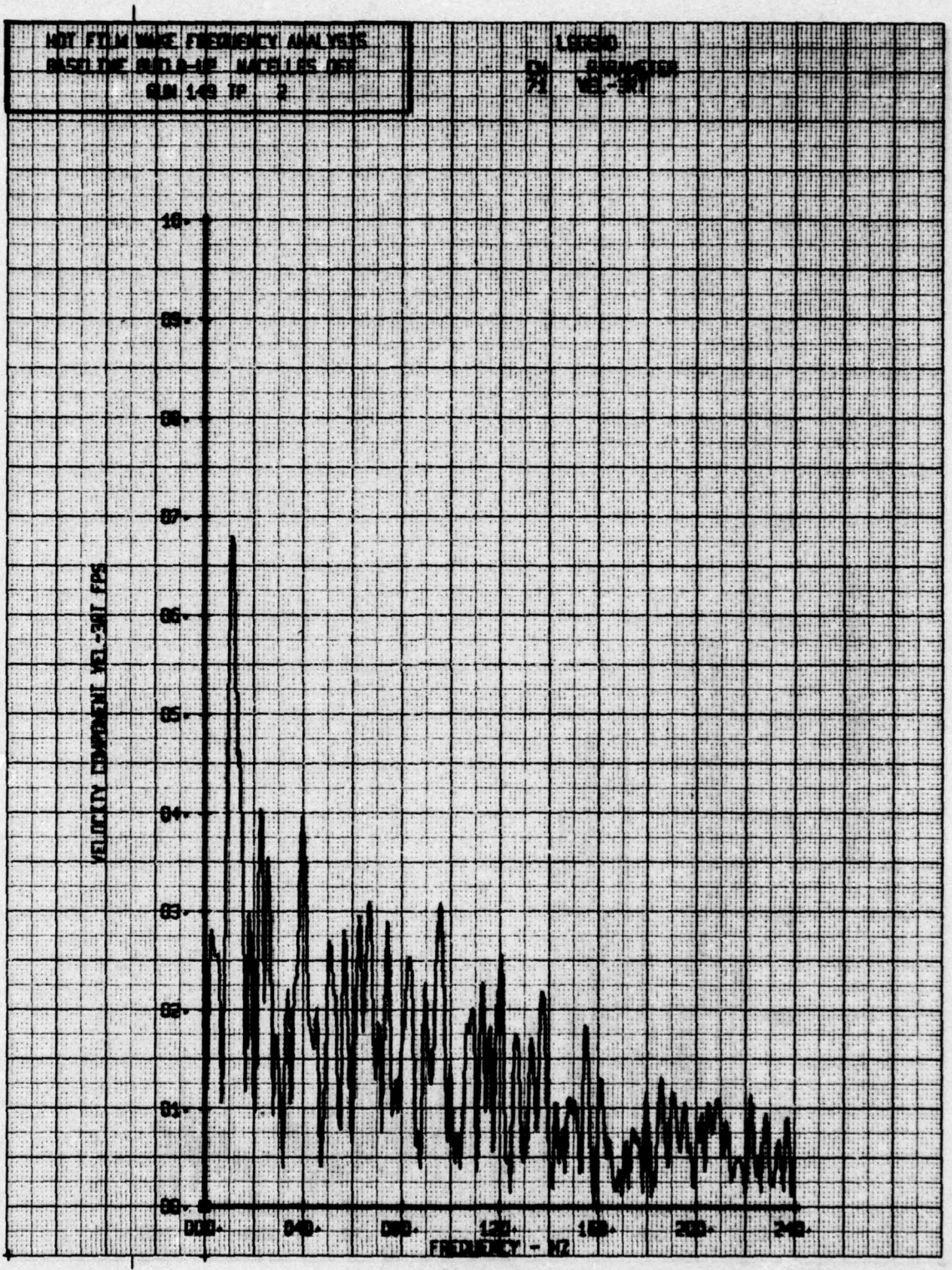
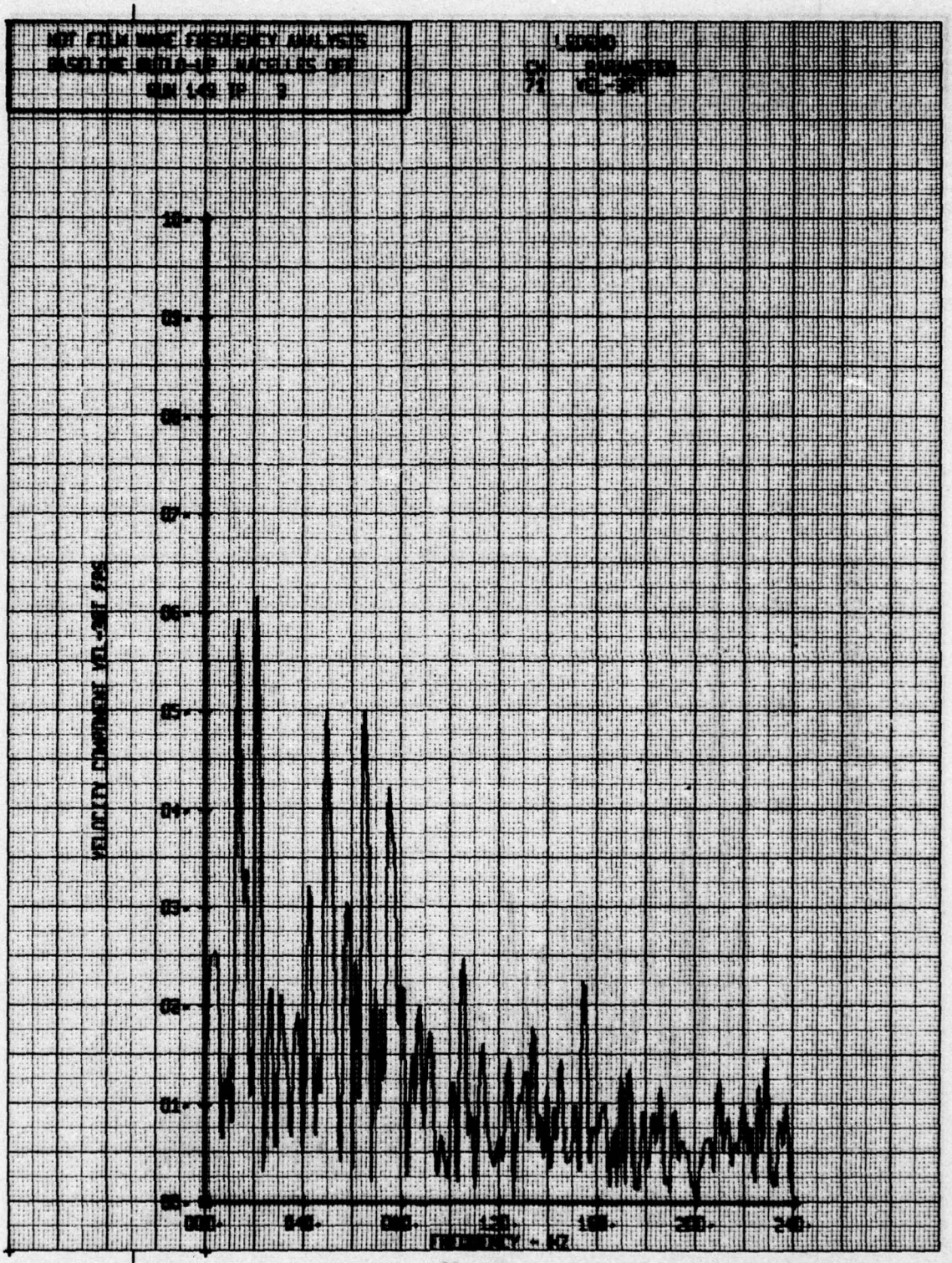
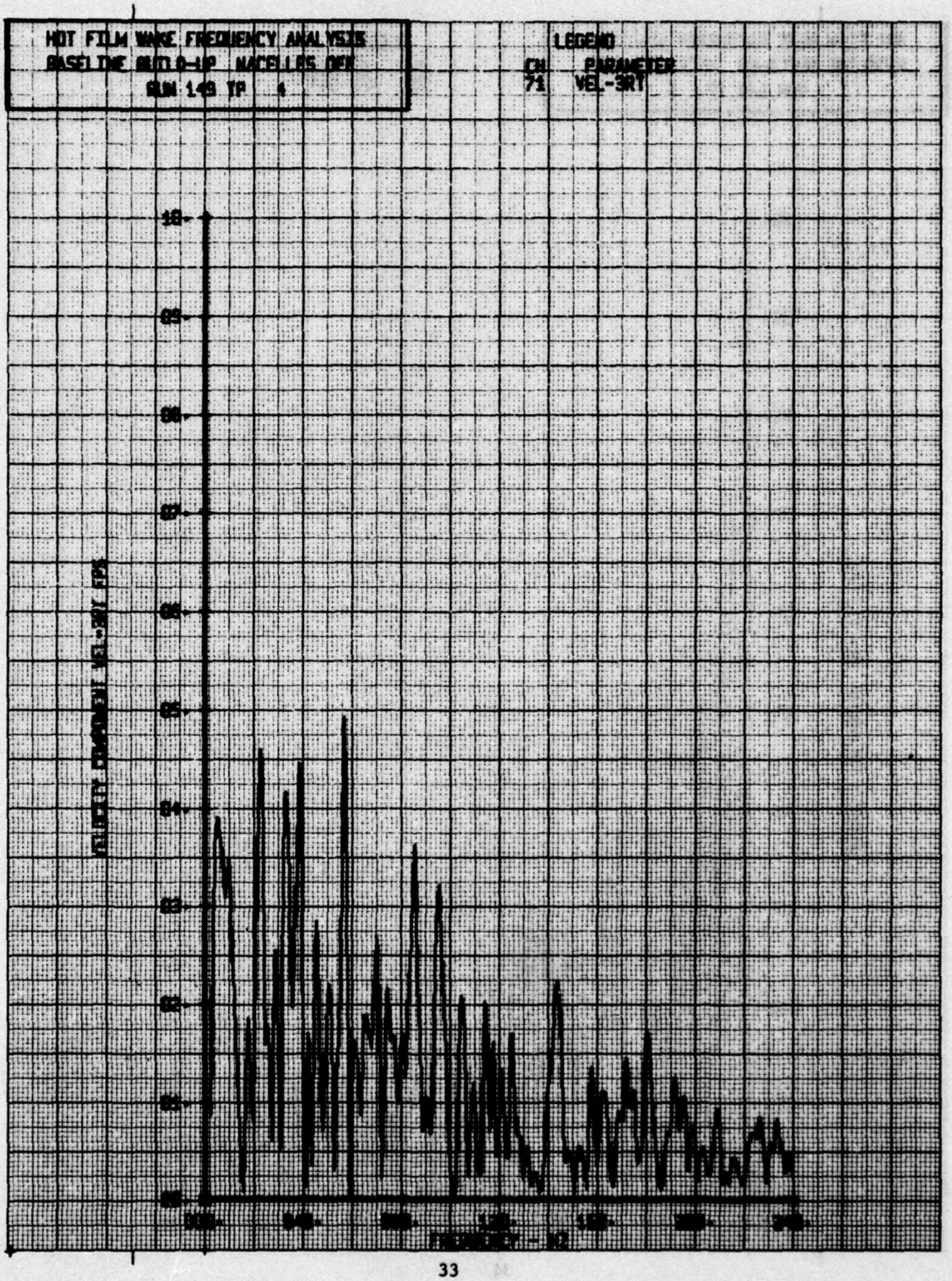
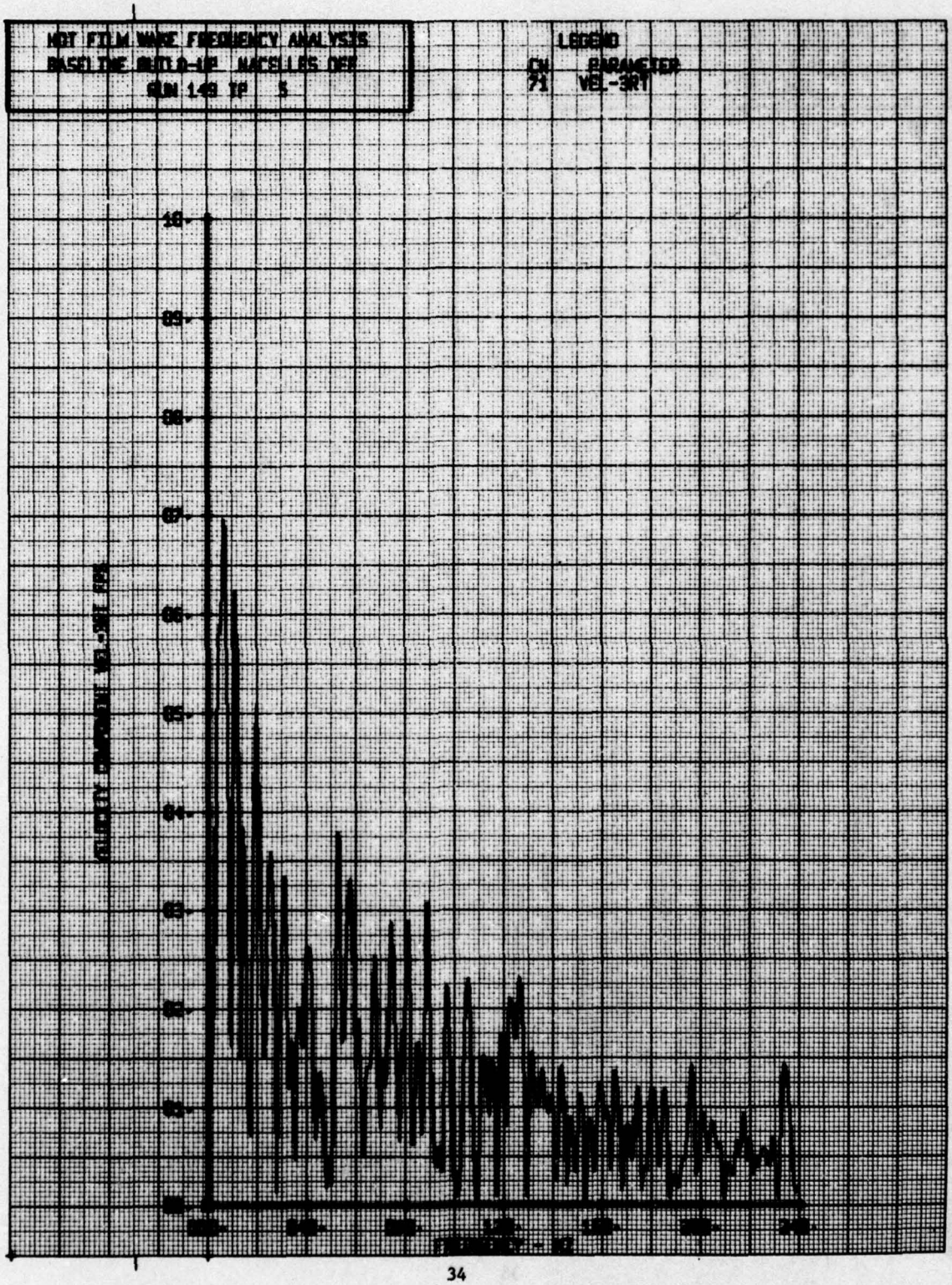


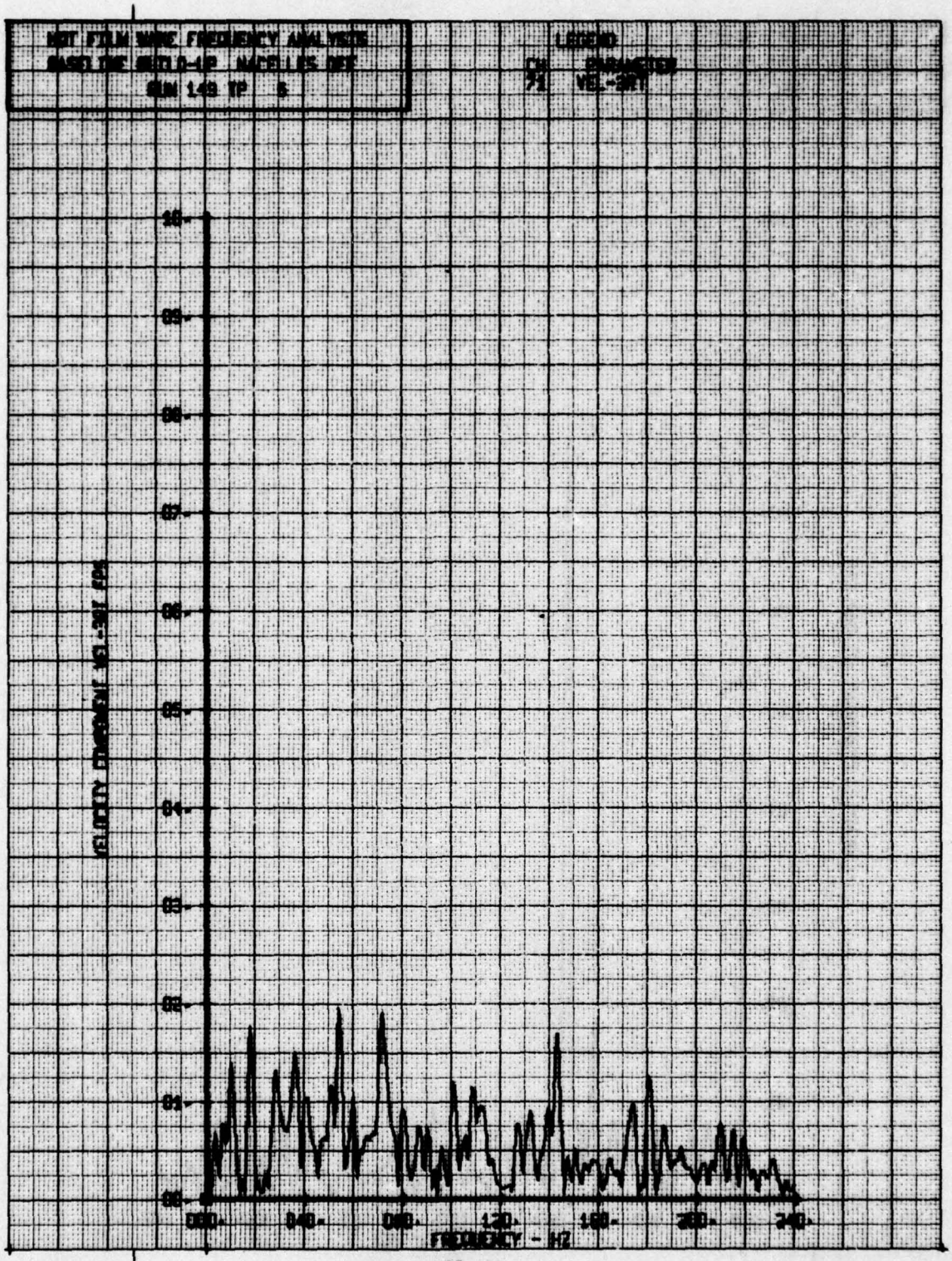
FIGURE 7 -1/4.85 SCALE MODEL GEOMETRY AND SURFACE PRESSURE TRANSDUCER LOCATIONS

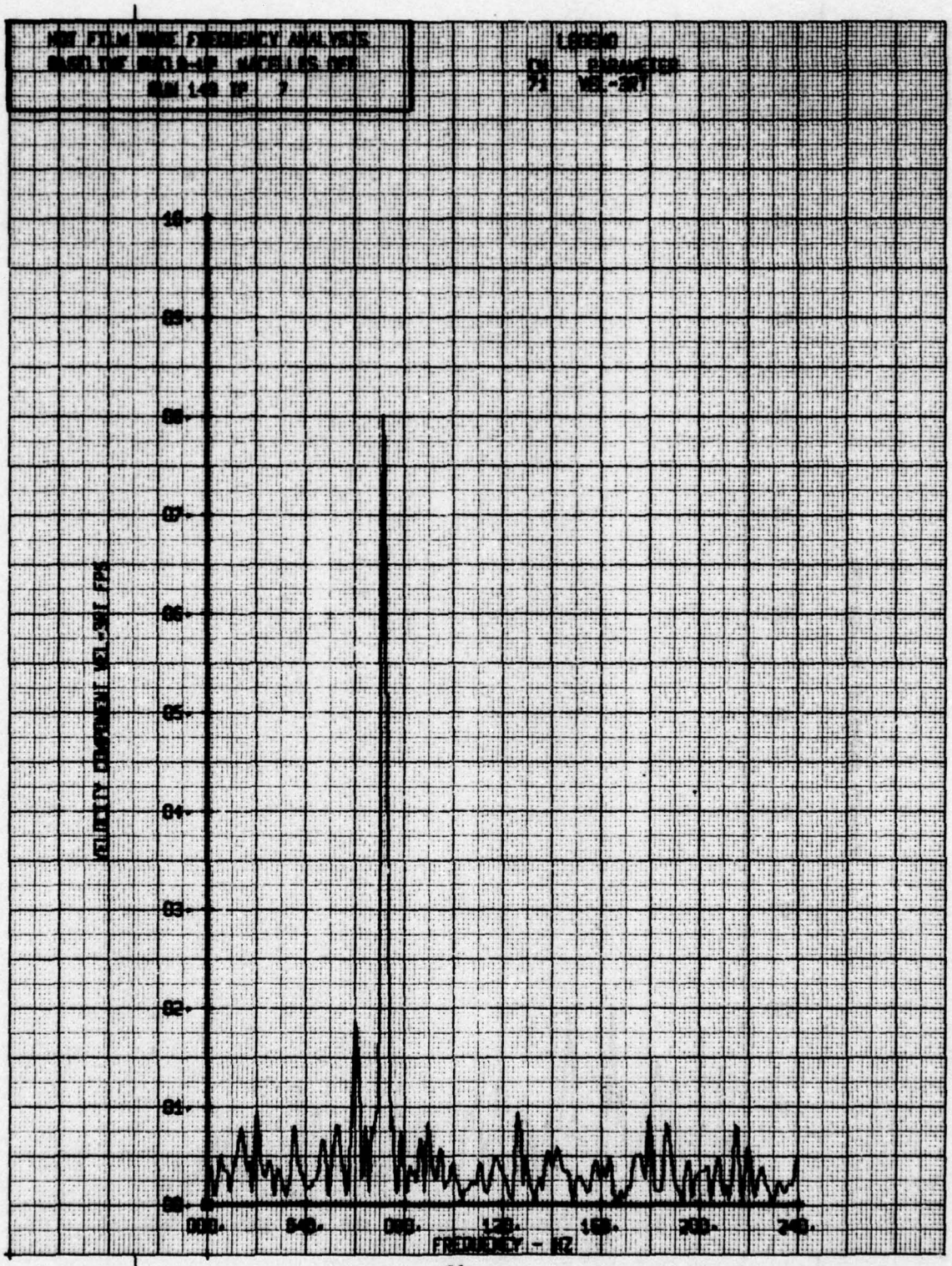

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 149 TP 2
LEGEND
VELOCITY COMPONENT VEL-30T FPS
FREQUENCY - HZ

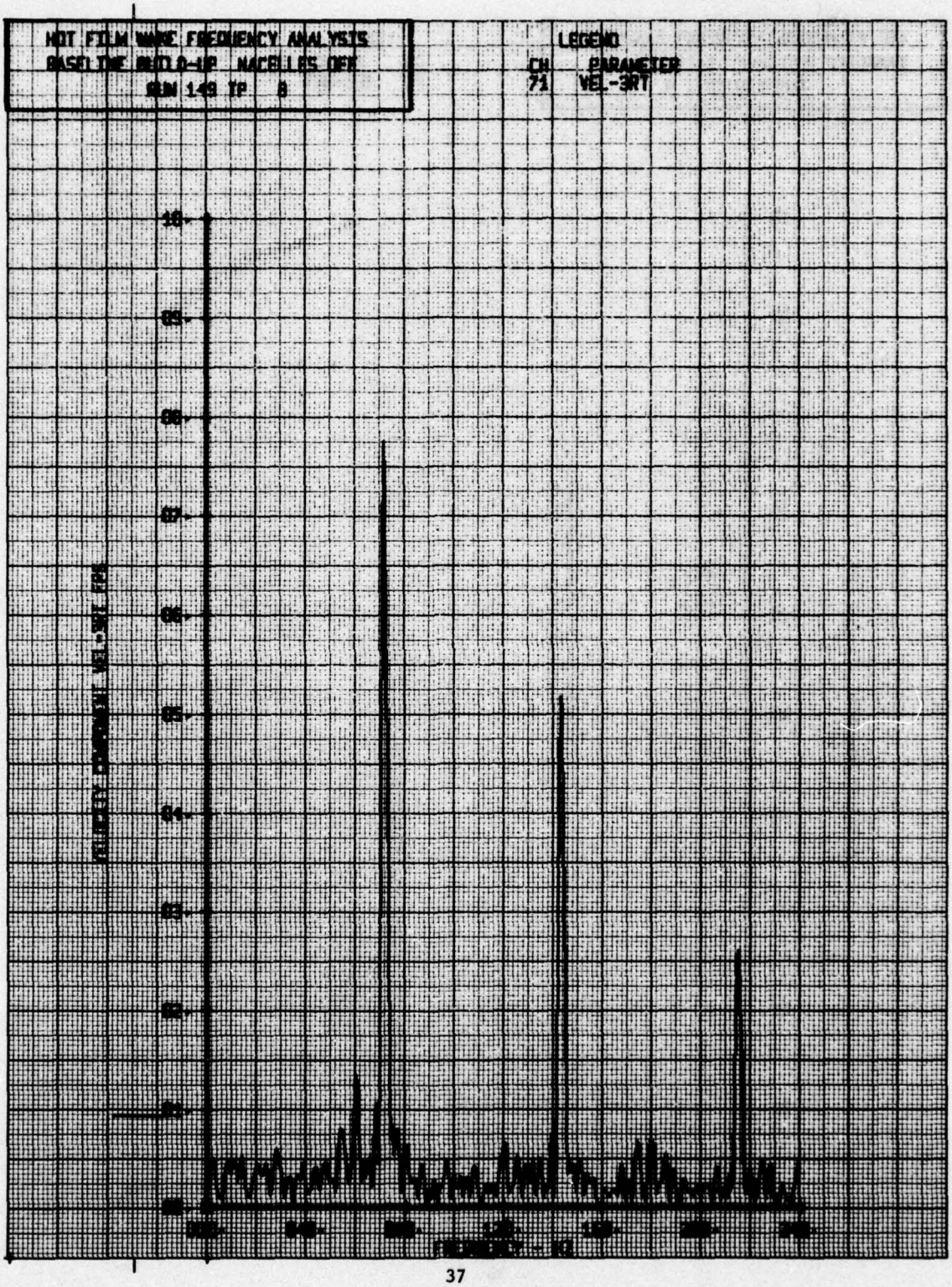

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE WITH A-IP NACELLE OFF
RUN 140 TP 3
LEGEND
CH PARAMETER
VEL-INT
VELOCITY COMPONENT VEL-INT FPS
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
.00
000
040
080
120
160
200
240
FREQUENCY - HZ

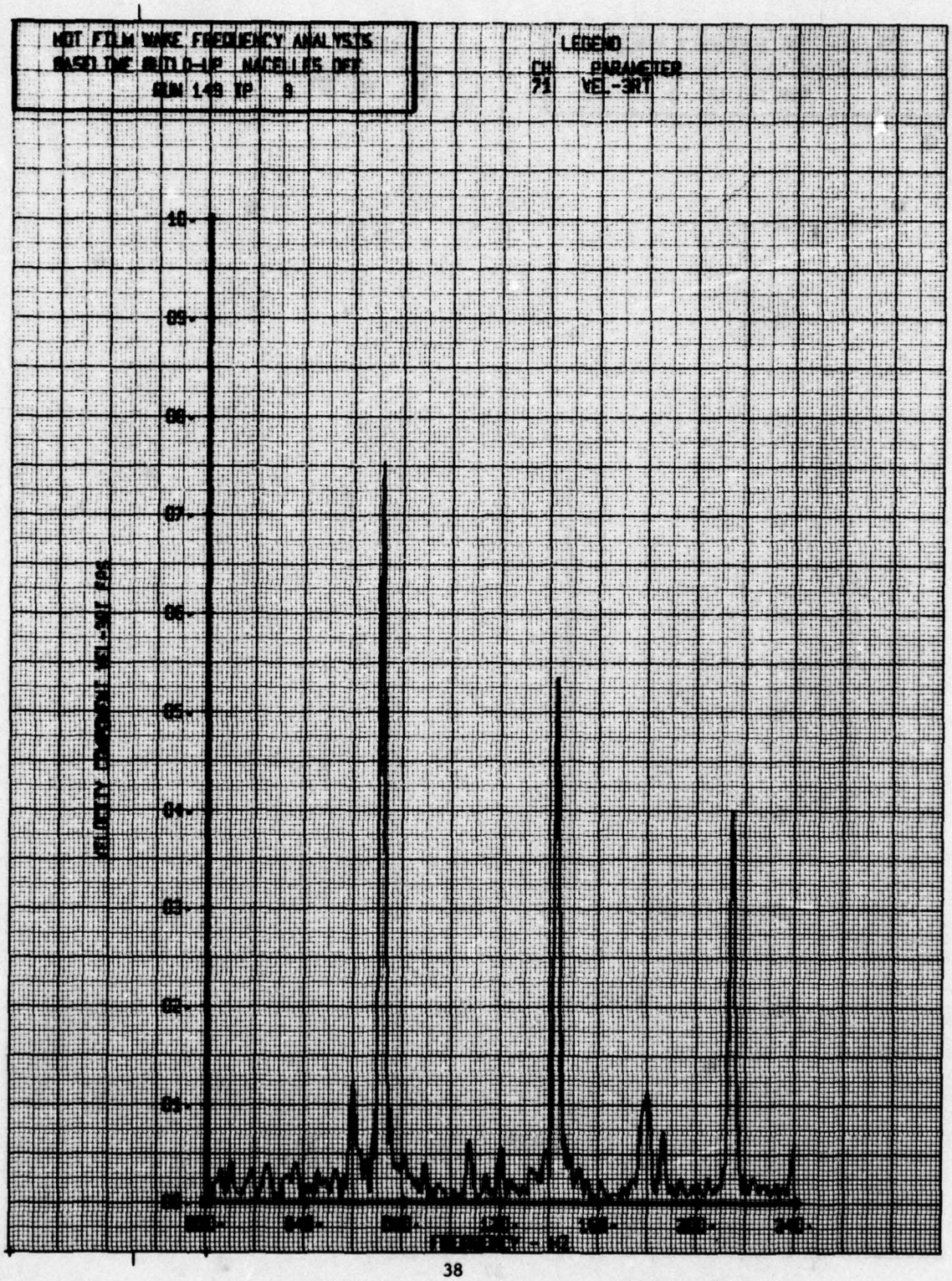

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE AUTO-UP NACELLES OFF
RUN 149 TP 4
LEGEND
CH PARAMETER
71 VEL-3RT
10
09
08
07
06
05
04
03
02
01
00
FREQUENCY - HZ

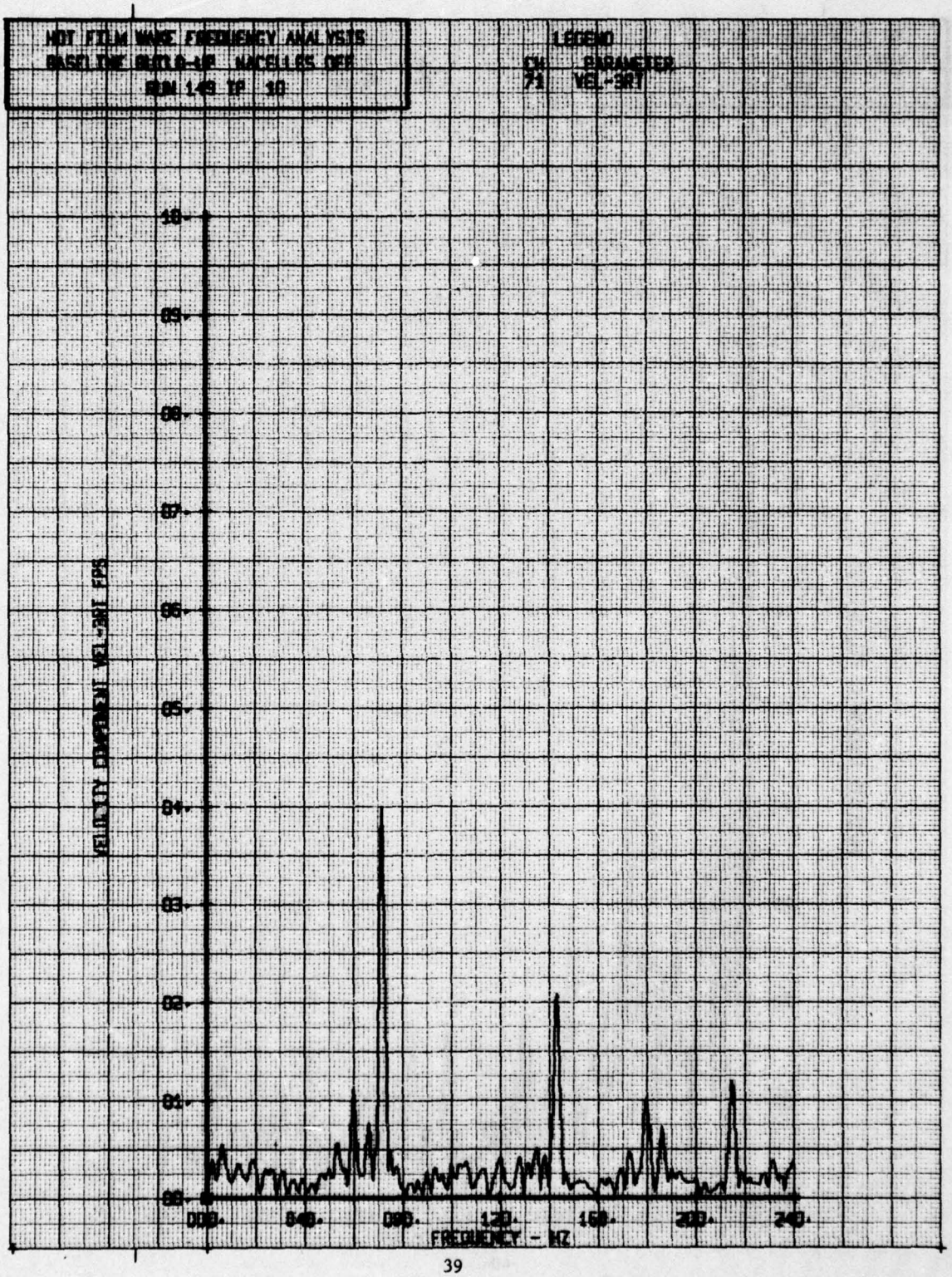

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE WING-UP NACELLES OFF
RUN 143 TP 5
LEGEND
CH PARAMETER
71 VEL.-3RT
10
09
08
07
06
05
04
03
02
01
00
VELOCITY COMPONENT VEL.-3RT FOR

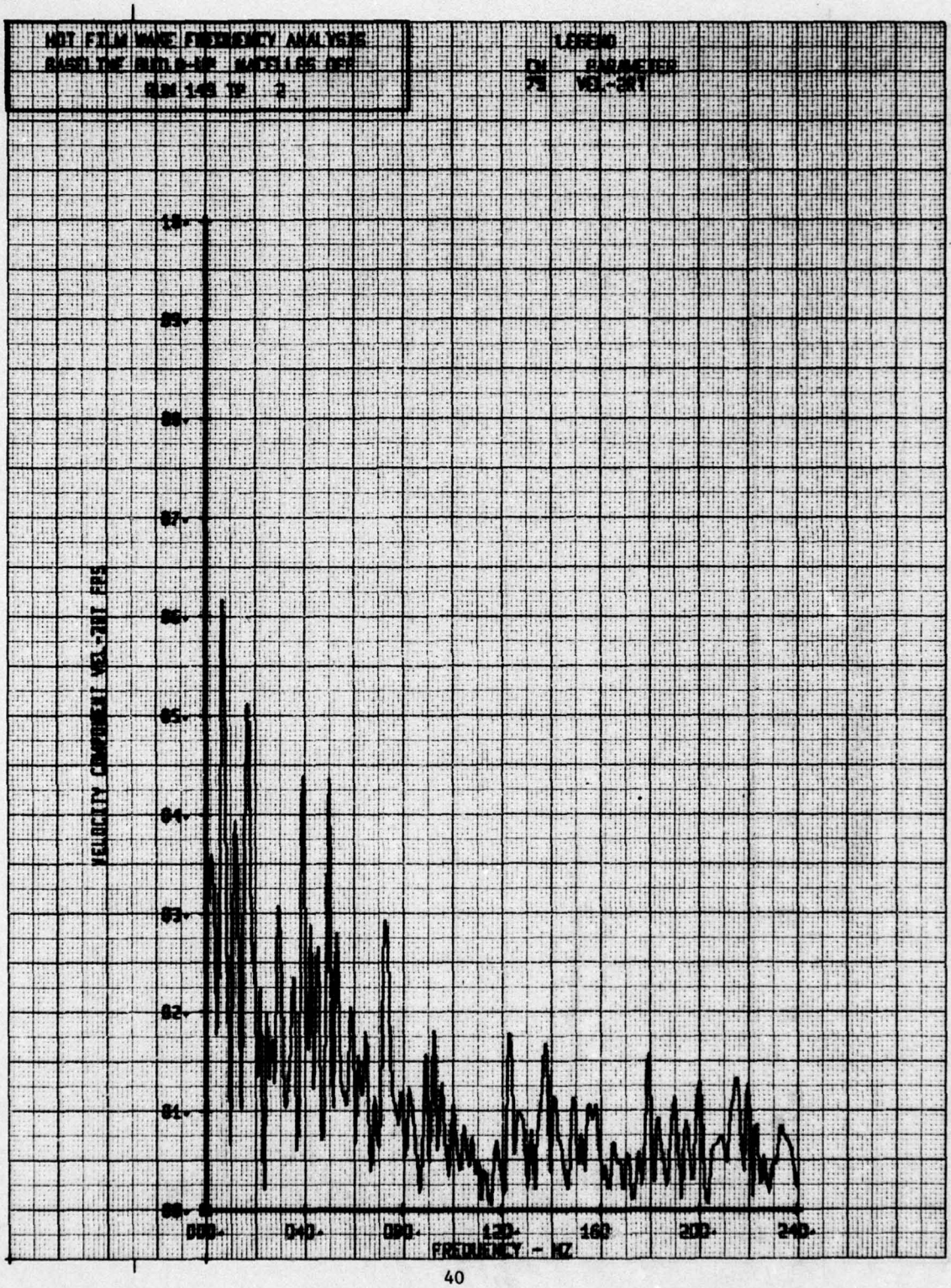

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE WING-UP NACELLES SET
RUN 149 TP 6
LEGEND
CH CHARACTER
P1 VEL.-SET
VELOCITY FLUCTUATION VEL.-SET FPS
FREQUENCY - HZ

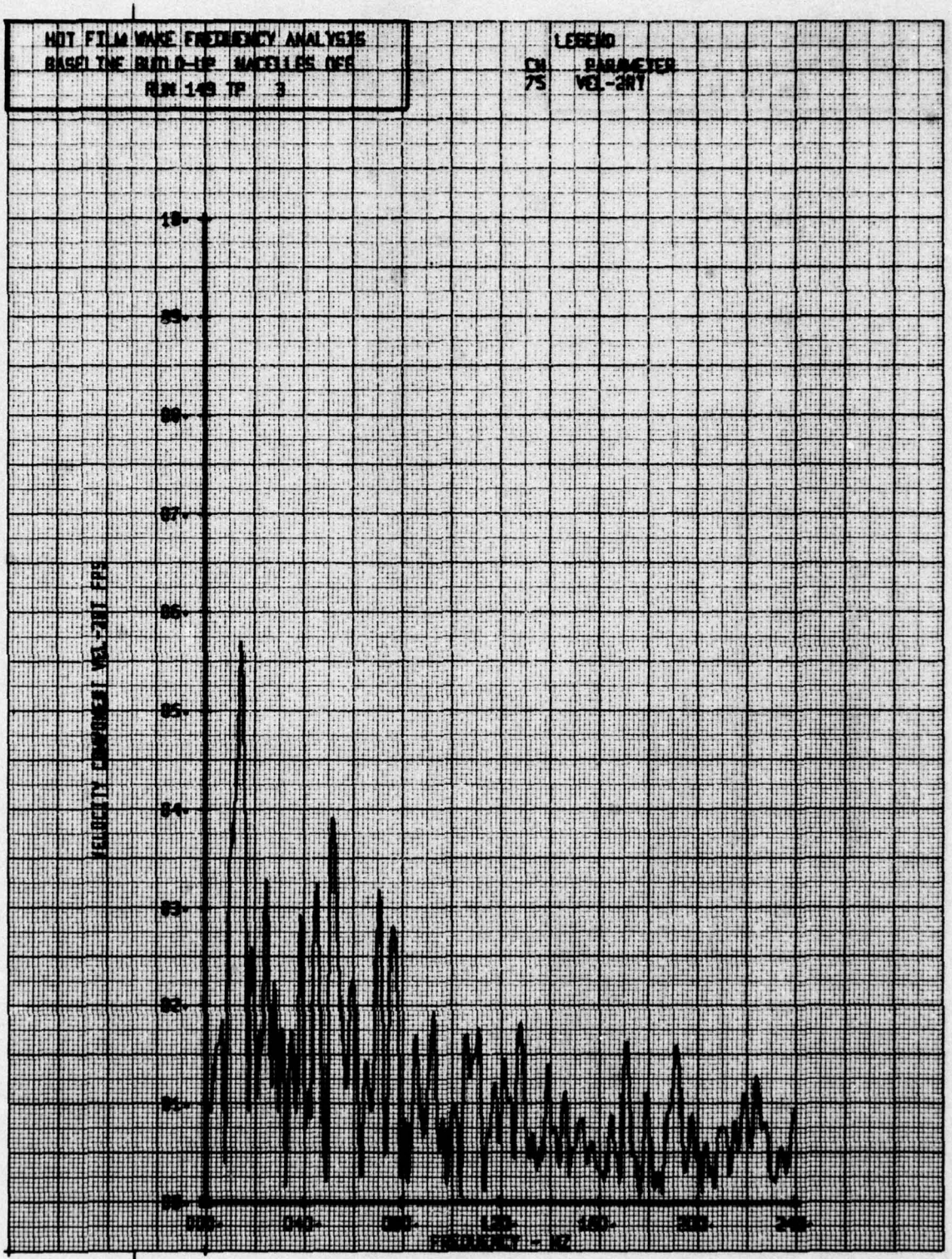

LEGEND
CH PARAMETER
FT VEL-SRT
VELOCITY COMPONENT, VEL-SRT, FPS
FREQUENCY - HZ

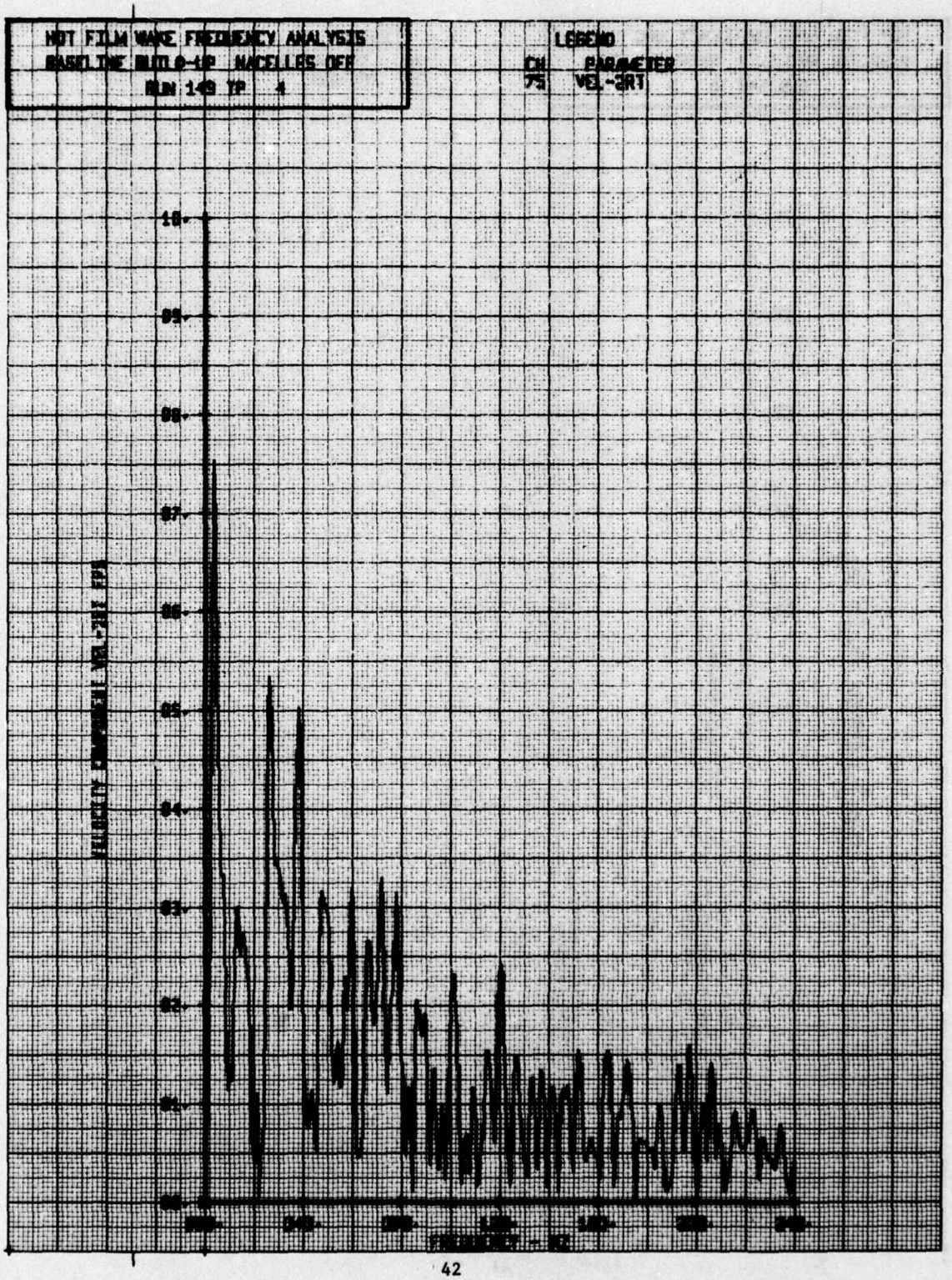

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE WING D-UP NACELLES OFF
RUN 149 TP 8
LEGEND
CH PARAMETER
71 VEL-3RT
FREQUENCY COMPONENT VEL-3RT FOR
10
09
08
07
06
05
04
03
02
01
00

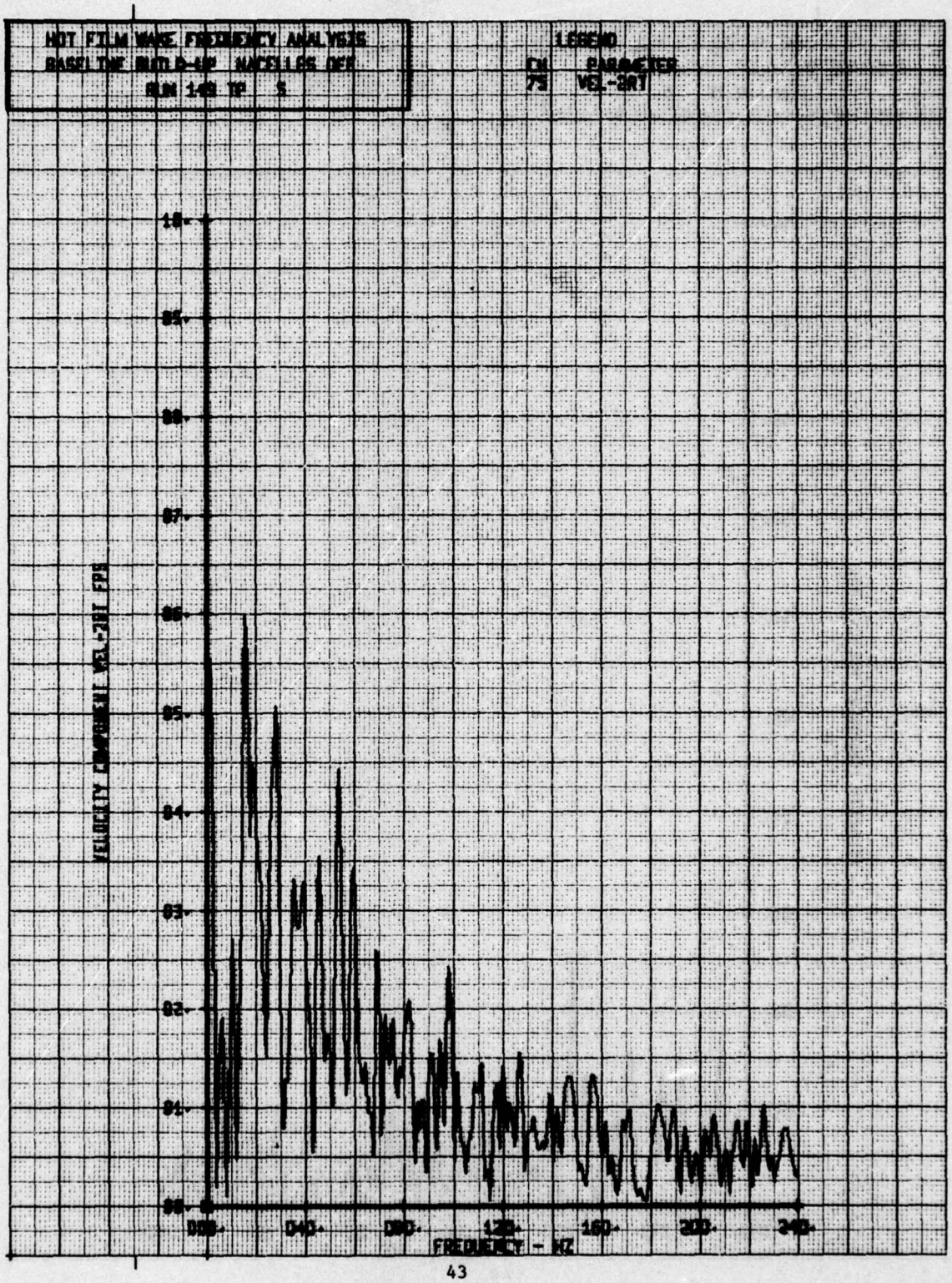

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUTTON-UP NACELLES OFF
RUN 149 TP 9
LEGEND
CH PARAMETER
71 VEL.-3RT
FREQUENCY (CYCLES PER REVOLUTION)
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
.00
.04
.08
.12
.16
.20
.24

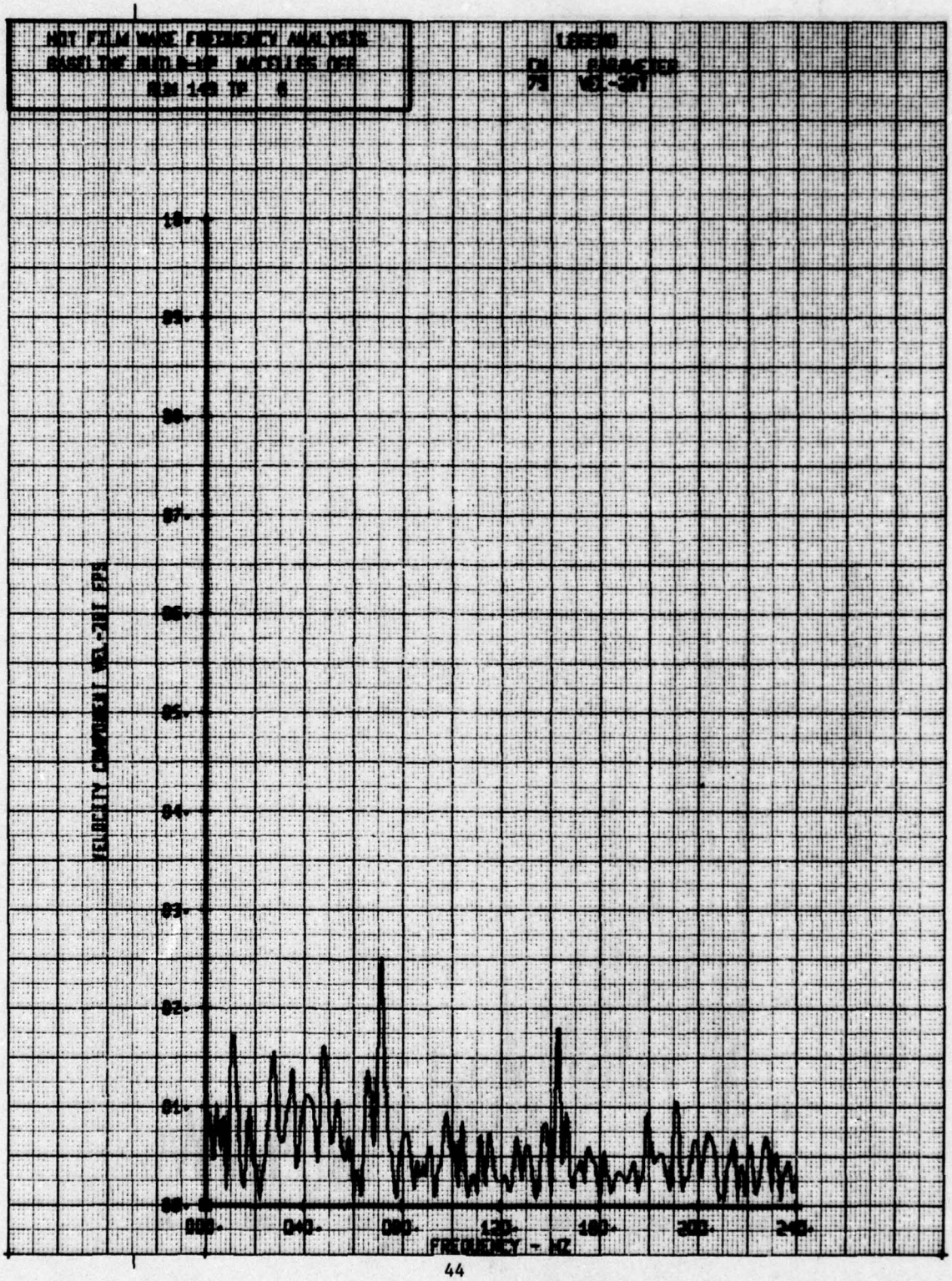

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE NACELLES OFF
RUN 149 TP 10
LEGEND
CH PARAMETER
P1 VEL-3RT
VELOCITY SPECTRUM LEVEL-3RT FPS
90.
89.
88.
87.
86.
85.
84.
83.
82.
81.
80.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

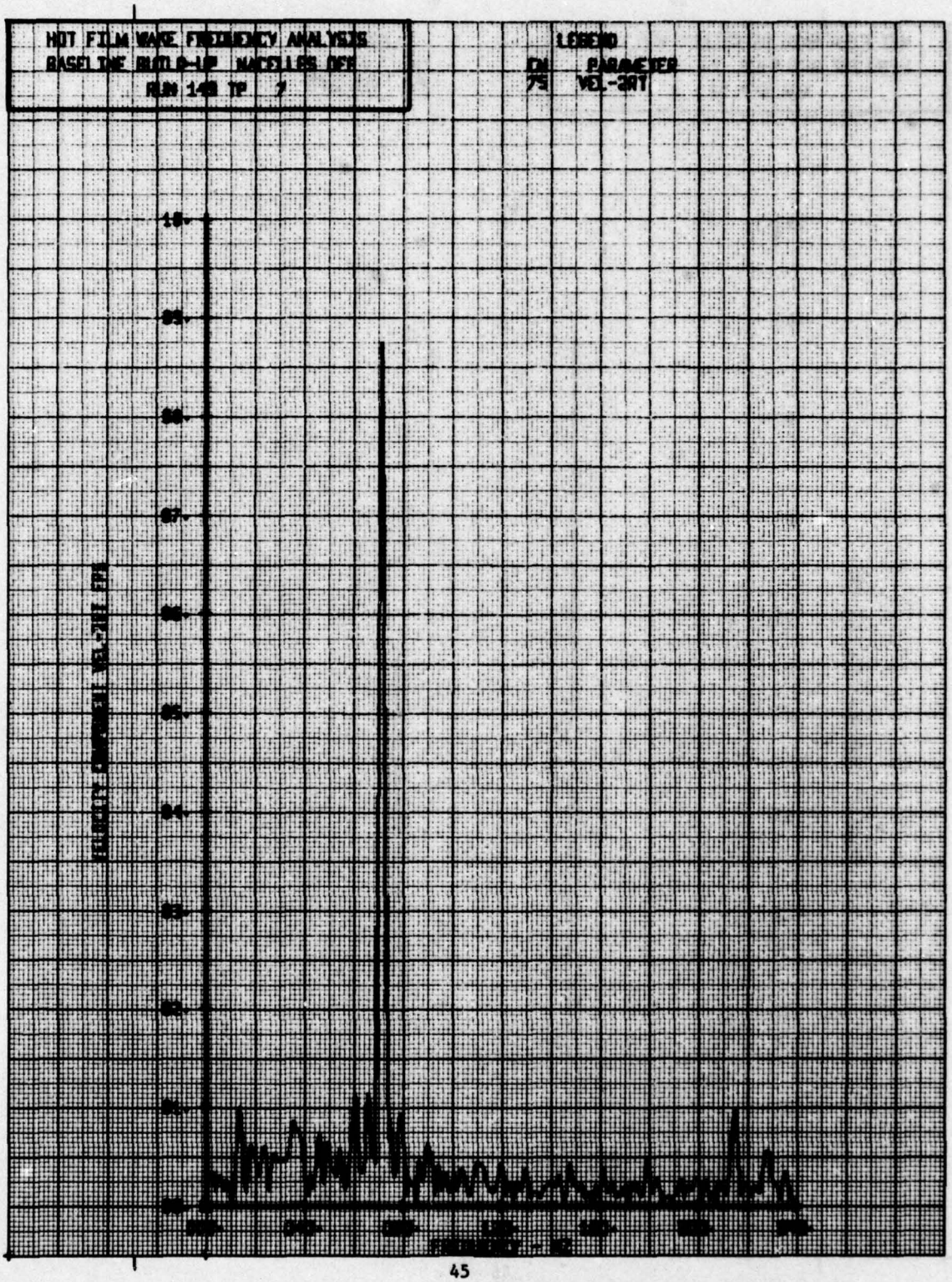

HOT FILM WAKE FREQUENCY ANALYSIS
RADIATING BLADE-UP ACCELES OFF
RUN 148 TP 2
LEGEND
CH PARAMETER
P2 VEL-2RT
VELOCITY CHANGE - VEL-2RT FPS
FREQUENCY - HZ

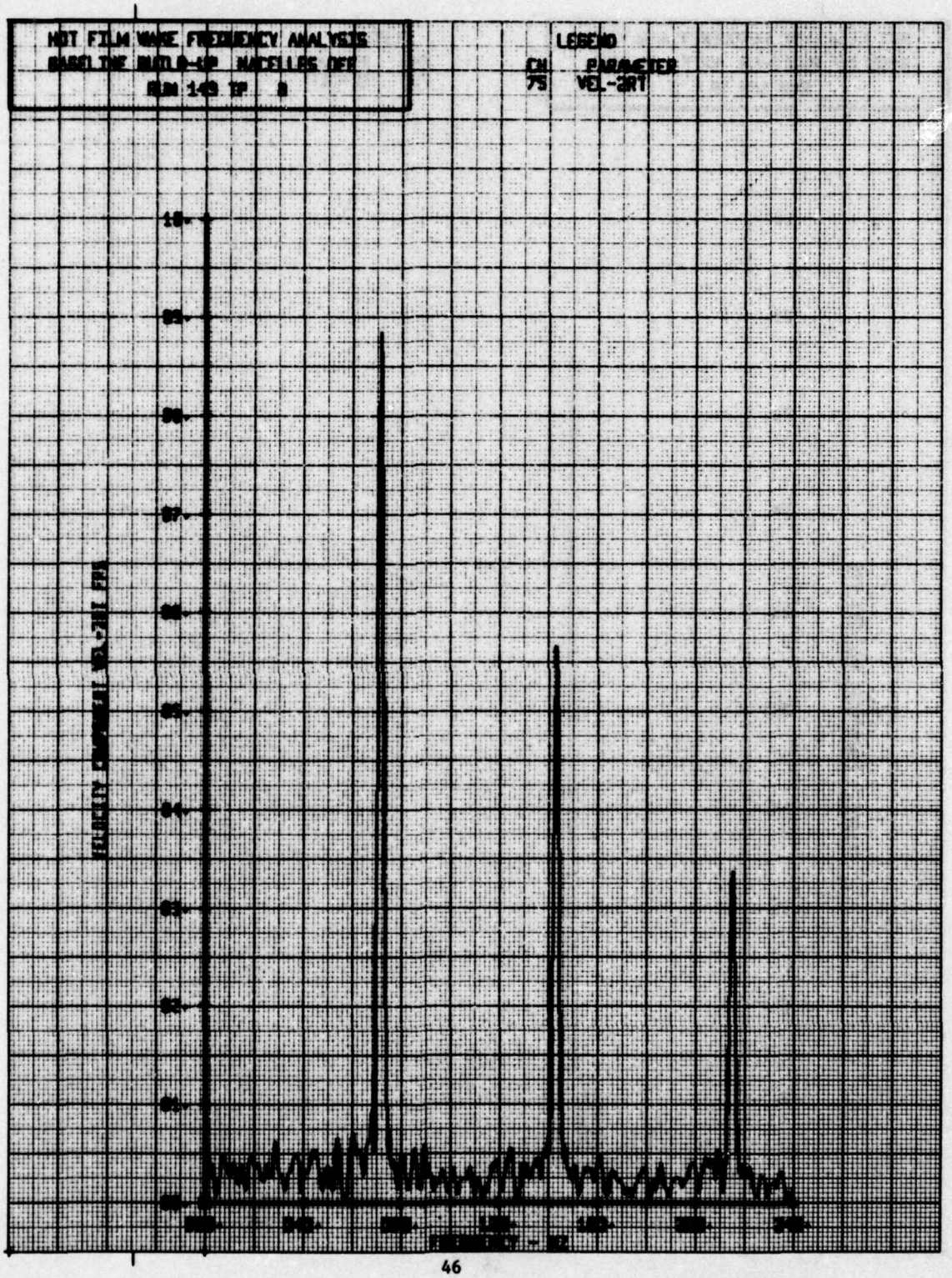

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 3
LEGEND
CH PARAMETER
75 VEL-2RT
VELOCITY COMPONENT VEL-2RT FPS
89.
88.
87.
86.
85.
84.
83.
82.
81.
80.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

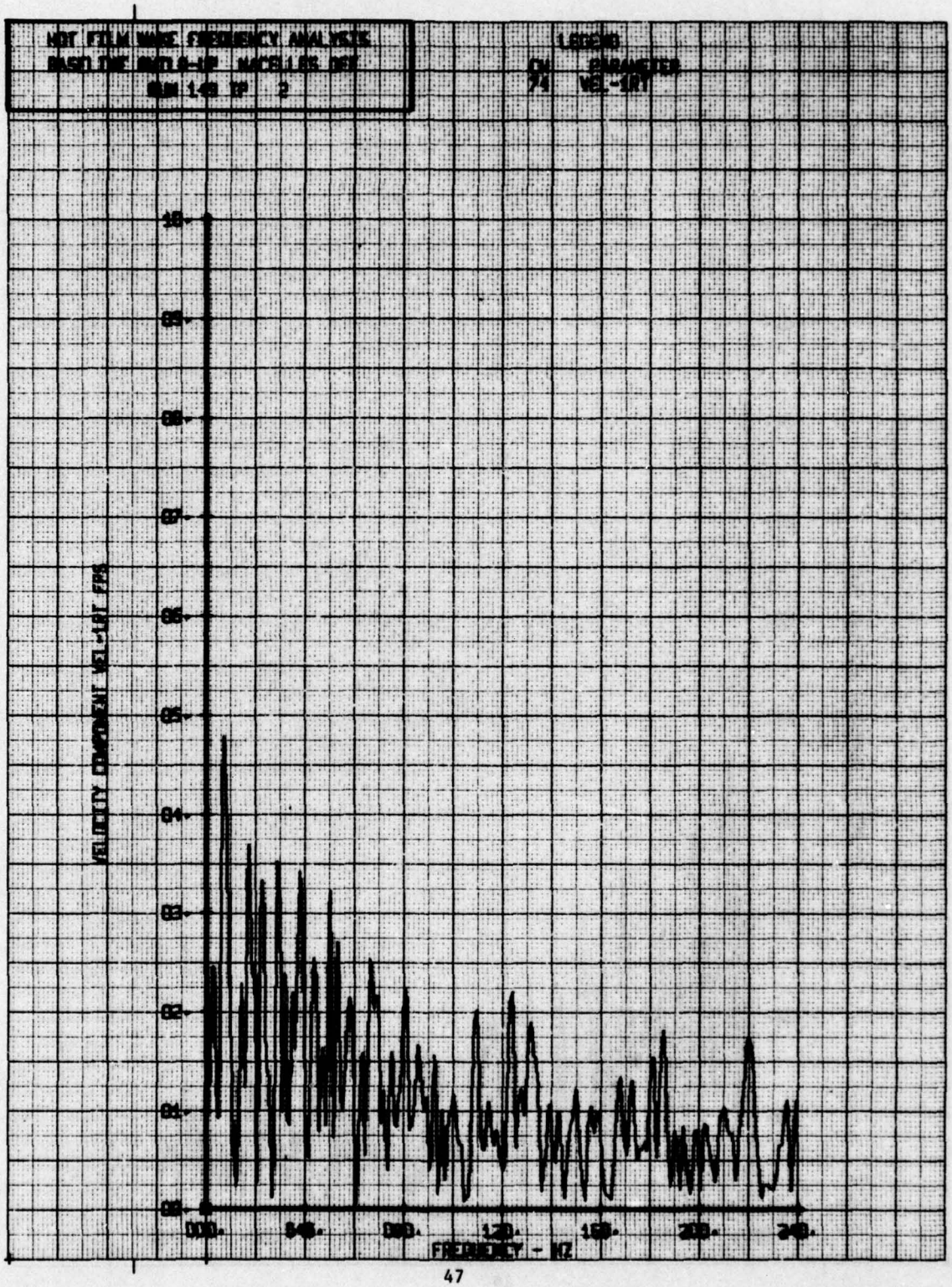

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 4
LEGEND
CH PARAMETER
75 VEL-2RT
VELOCITY COMPONENT VEL-2RT FPS
FREQUENCY - HZ

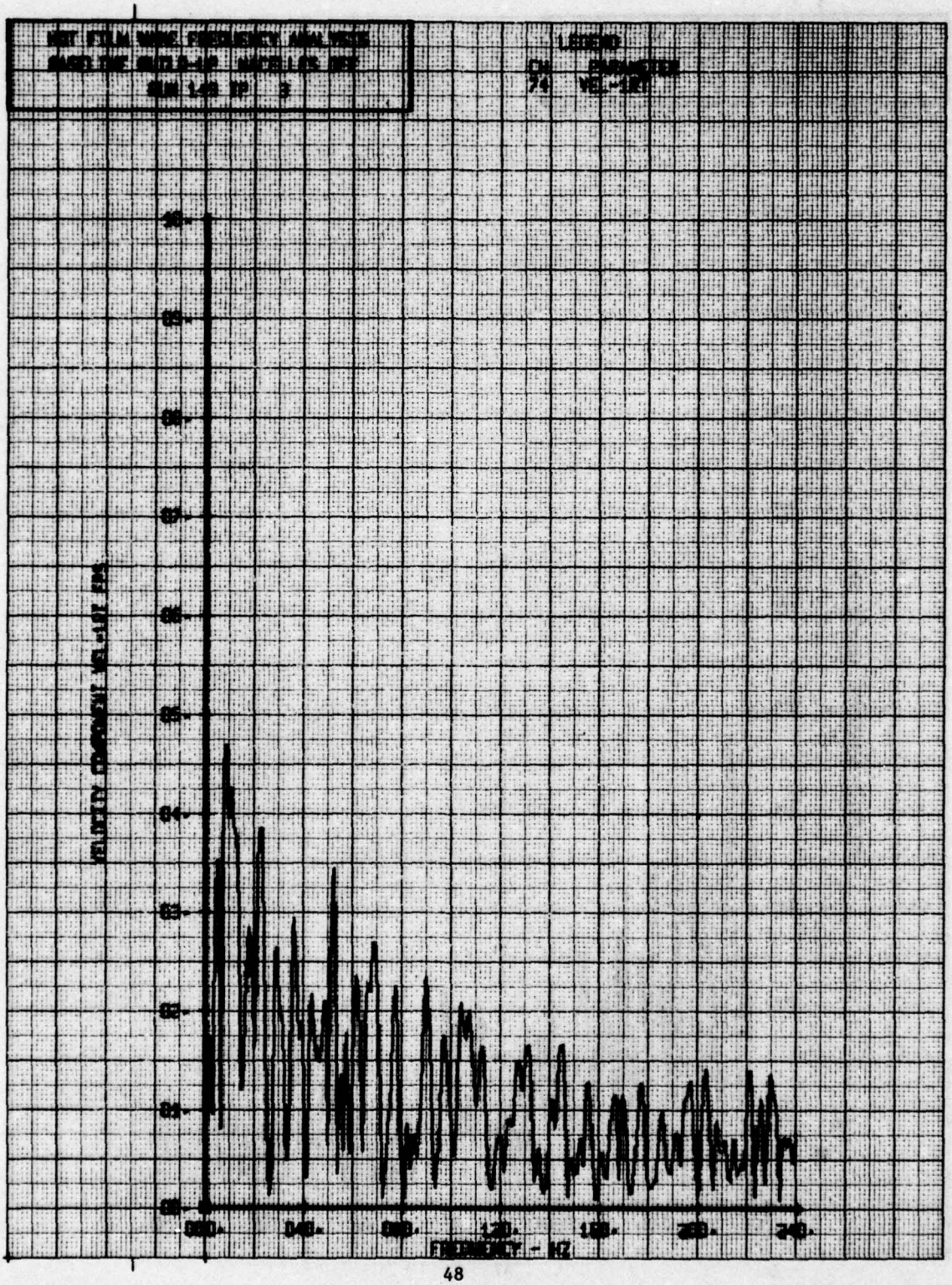

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE WITH P-UP NACELLES OFF
RUN 148 TP 5
LEGEND
CH PARAMETER
75 VEL-2RT
VELOCITY COMPONENT VEL-2RT FPS
FREQUENCY - HZ

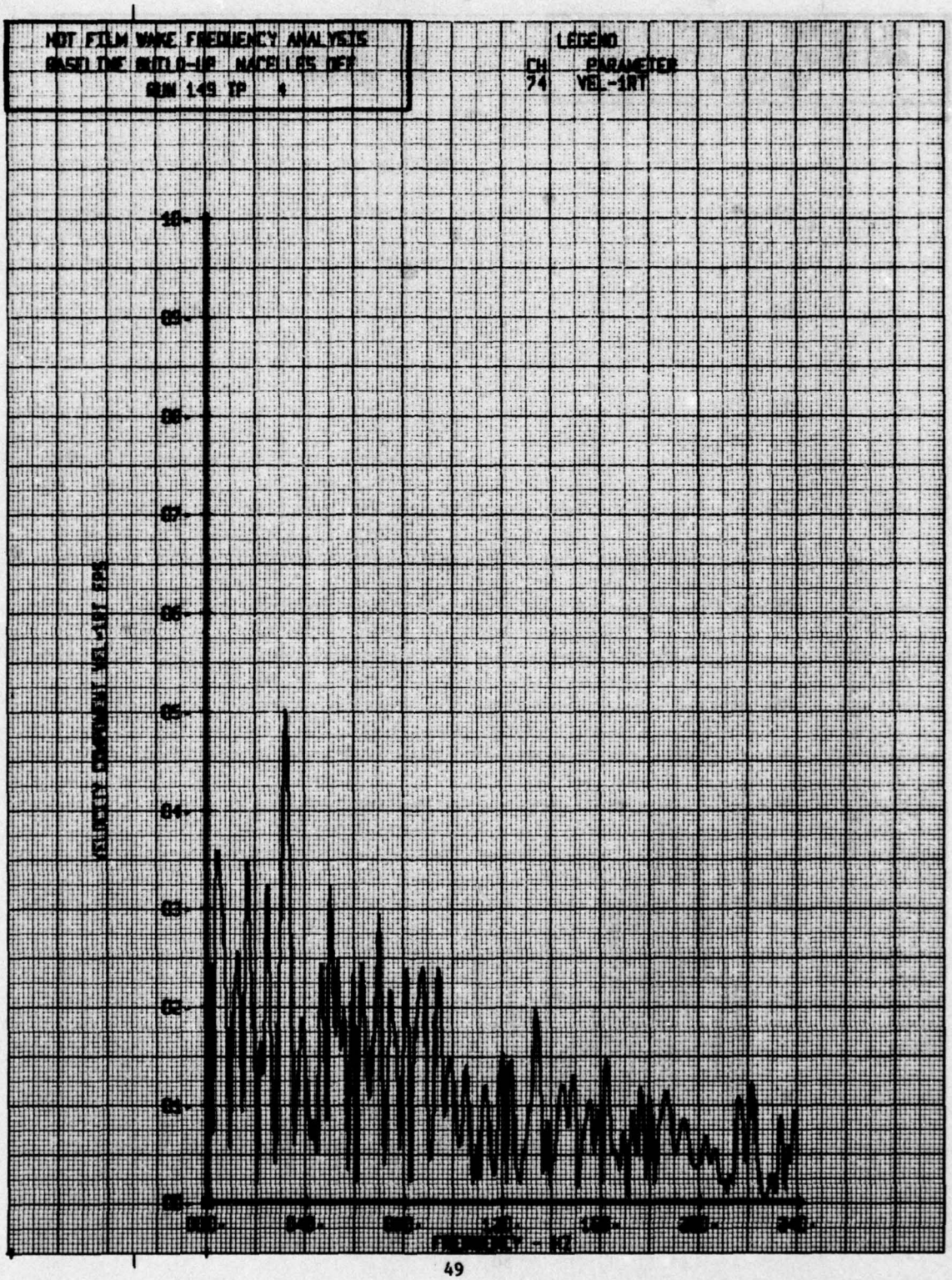

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 149 TP 4
LEGEND
CH CHARACTER
VELOCITY COMPONENT VEL-2HF FPS
FREQUENCY - HZ

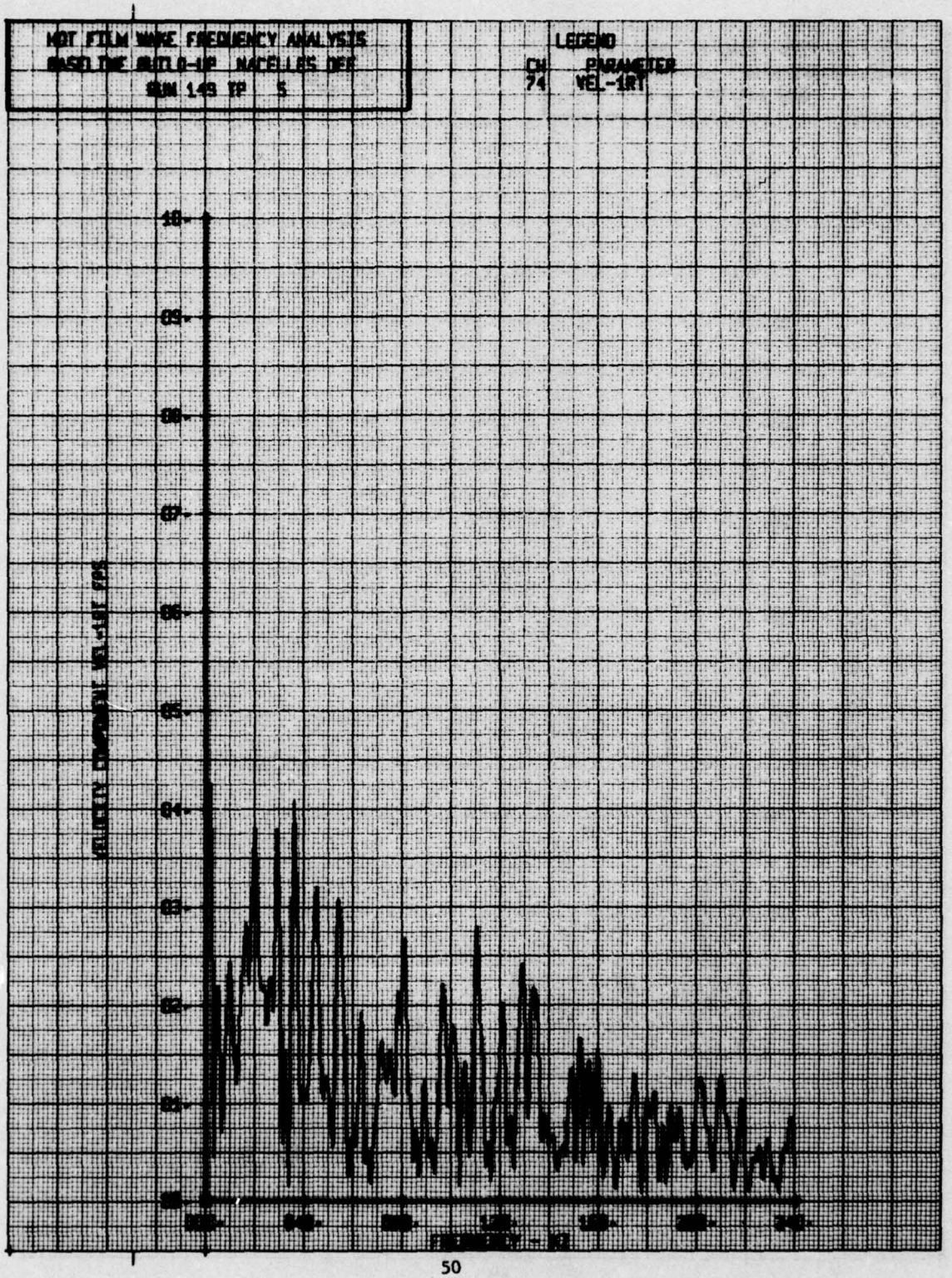

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUTLER-LIP NACELLES OFF
RUN 148 TP 7
LEGEND
FN PARAMETER
75 VEL-207
FREQUENCY CHANGE VEL-207 EPS

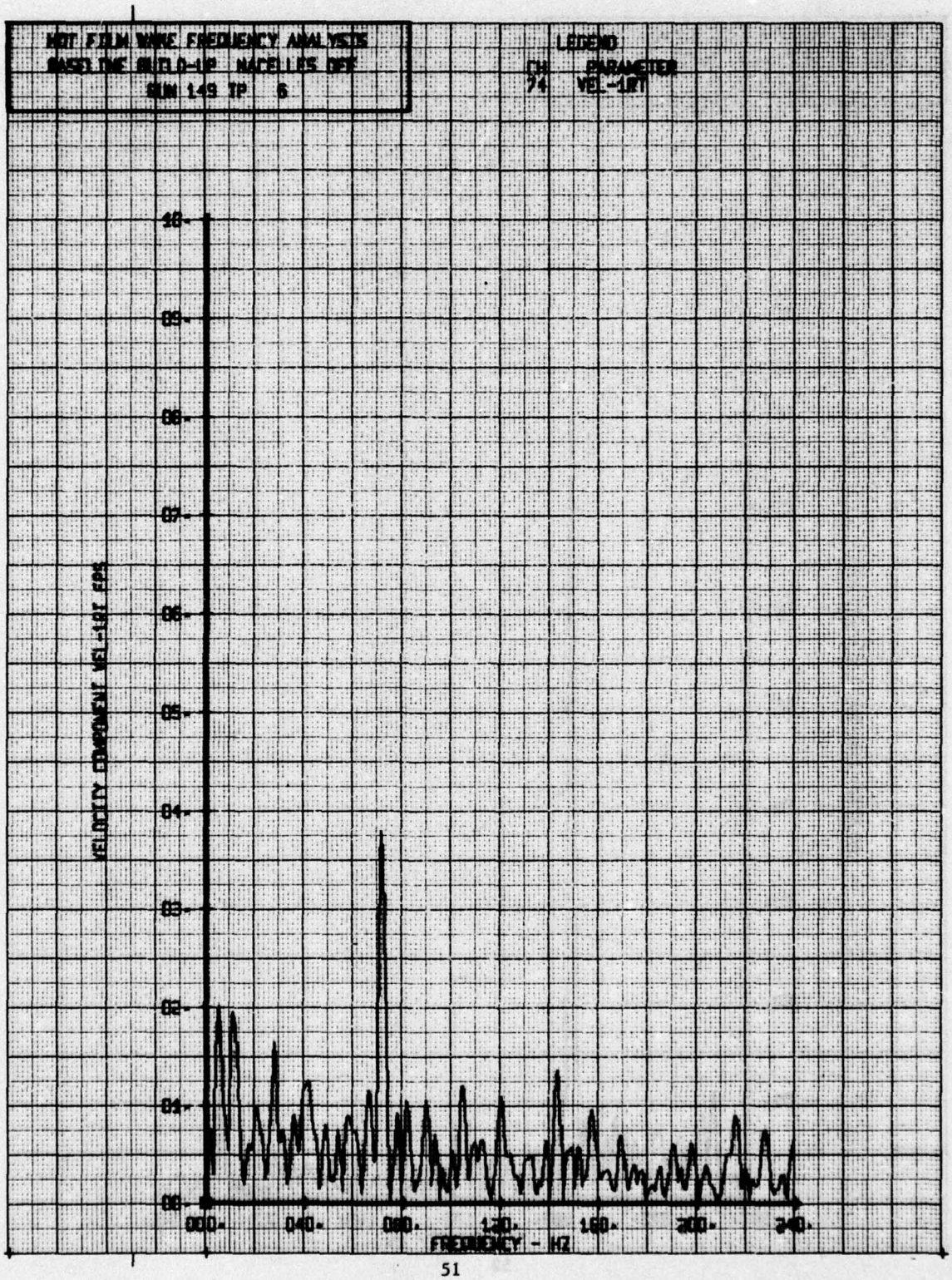

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 8
LEGEND
CH PARAMETER
75 VEL-2RT

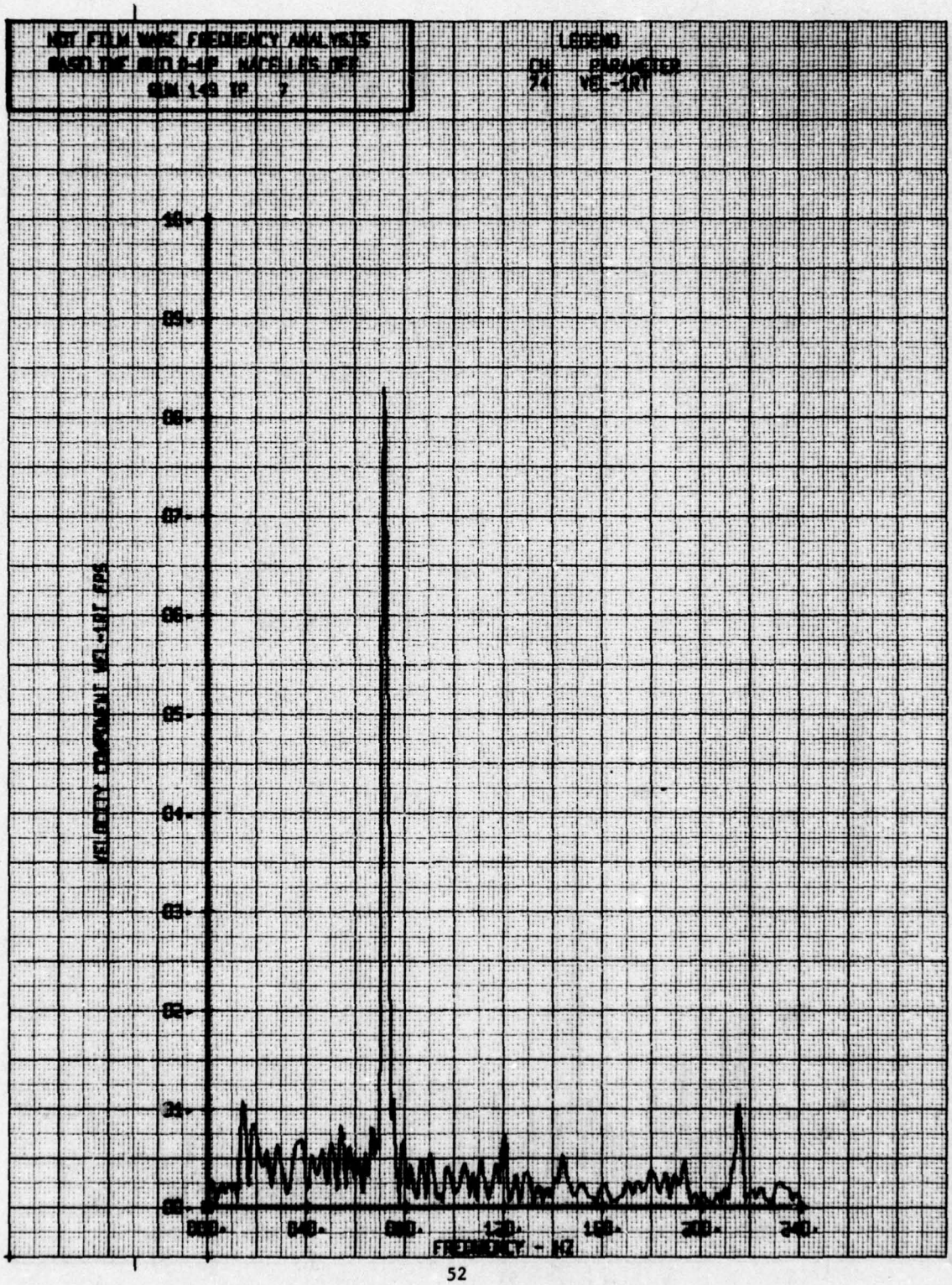

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE WITH 6-HP NACELLES OFF
RUN 148 TP 2
LEGEND
ON CHARACTER
74 VEL-INT
VELOCITY COMPONENT VEL-INT FPS
FREQUENCY - HZ

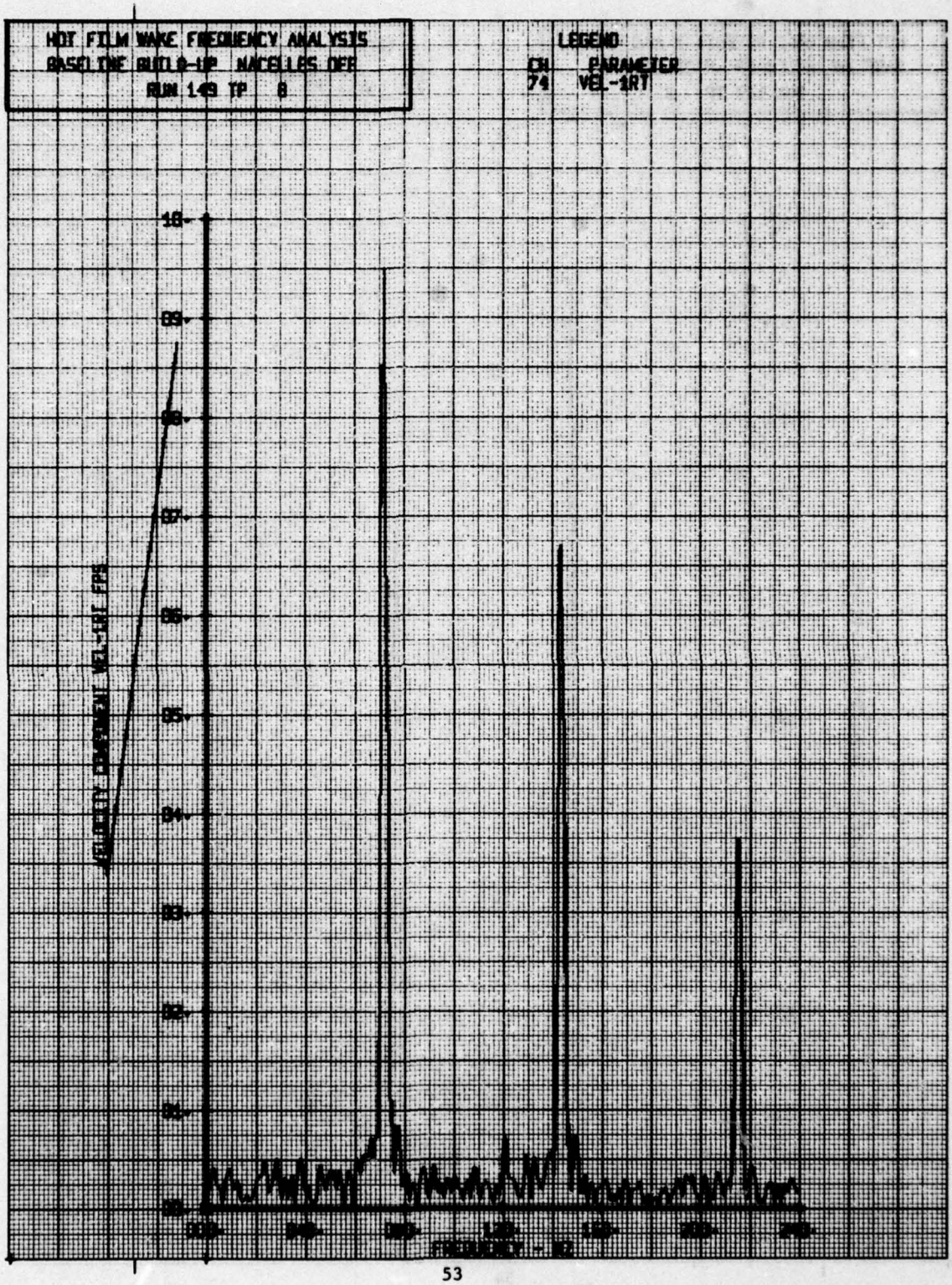

LEGEND
CH PARAMETER
74 VEL-12T
FREQUENCY - HZ

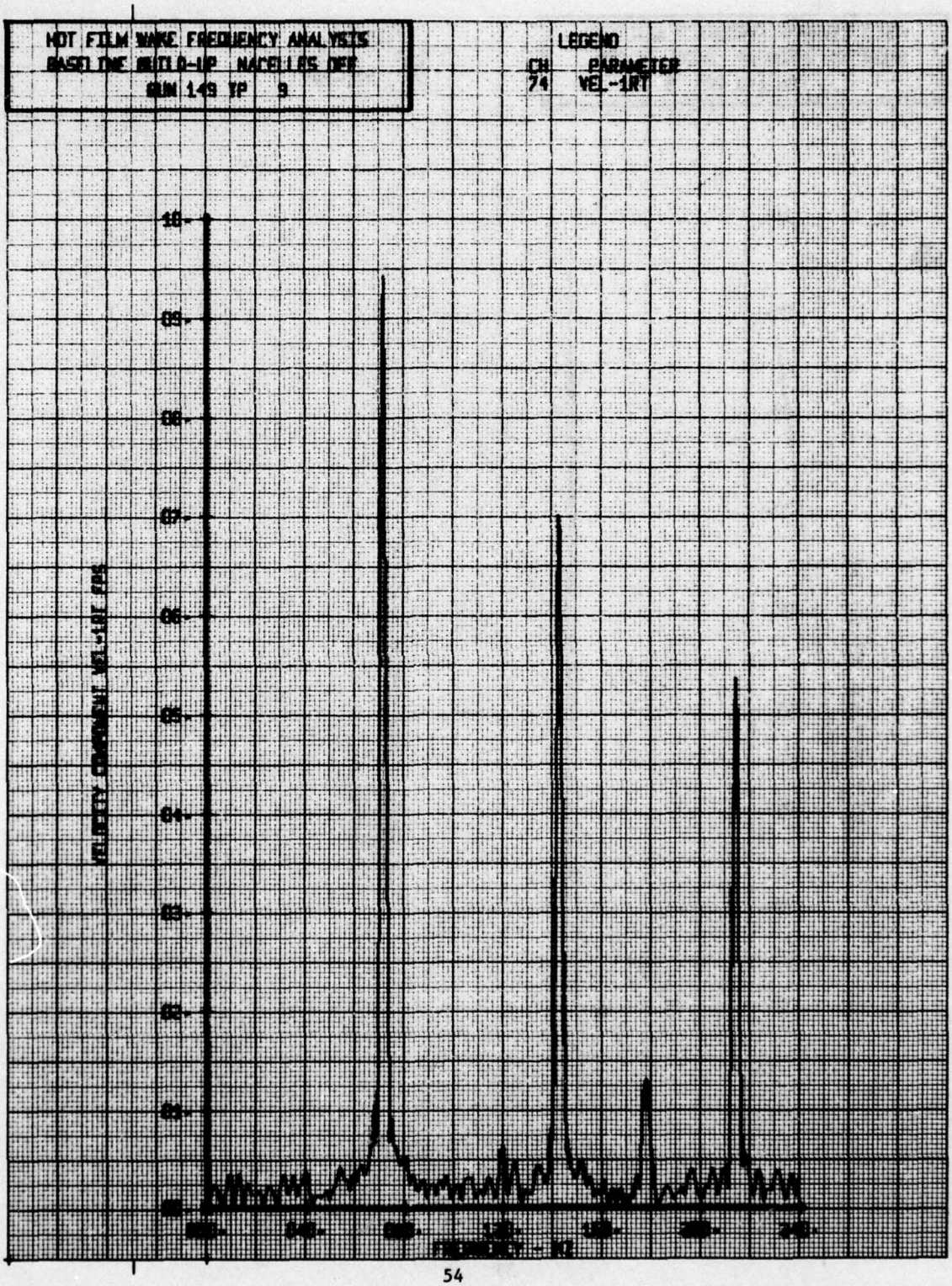

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 149 TP 4
LEGEND
CH PARAMETER
74 VEL-1RT

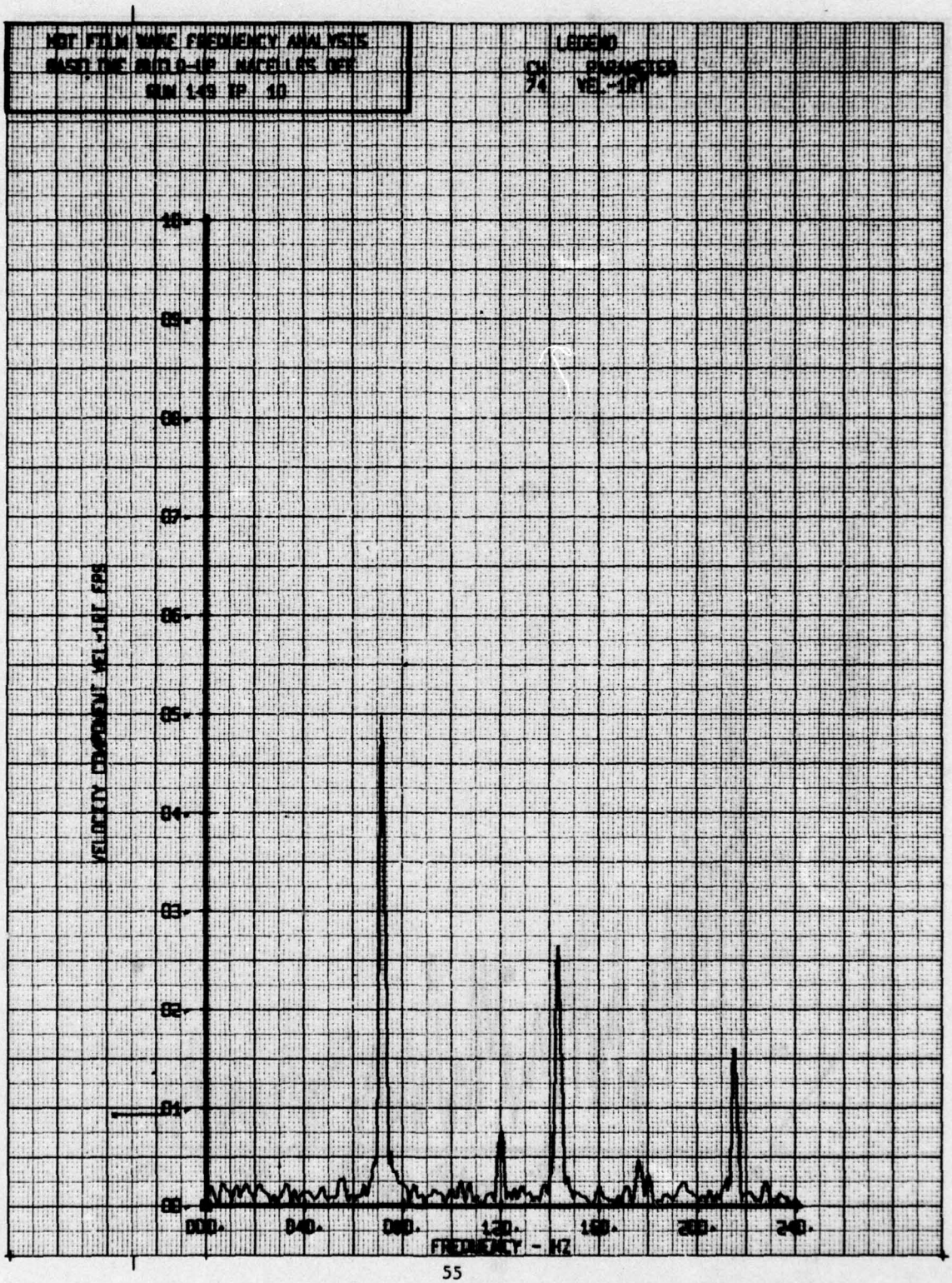

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE W/T/O-1P NACELLES DEF
RUN 143 TP 5
LEGEND
CH PARAMETER
74 VEL-1RT
FREQUENCY DOMAIN VELOCITY FPS

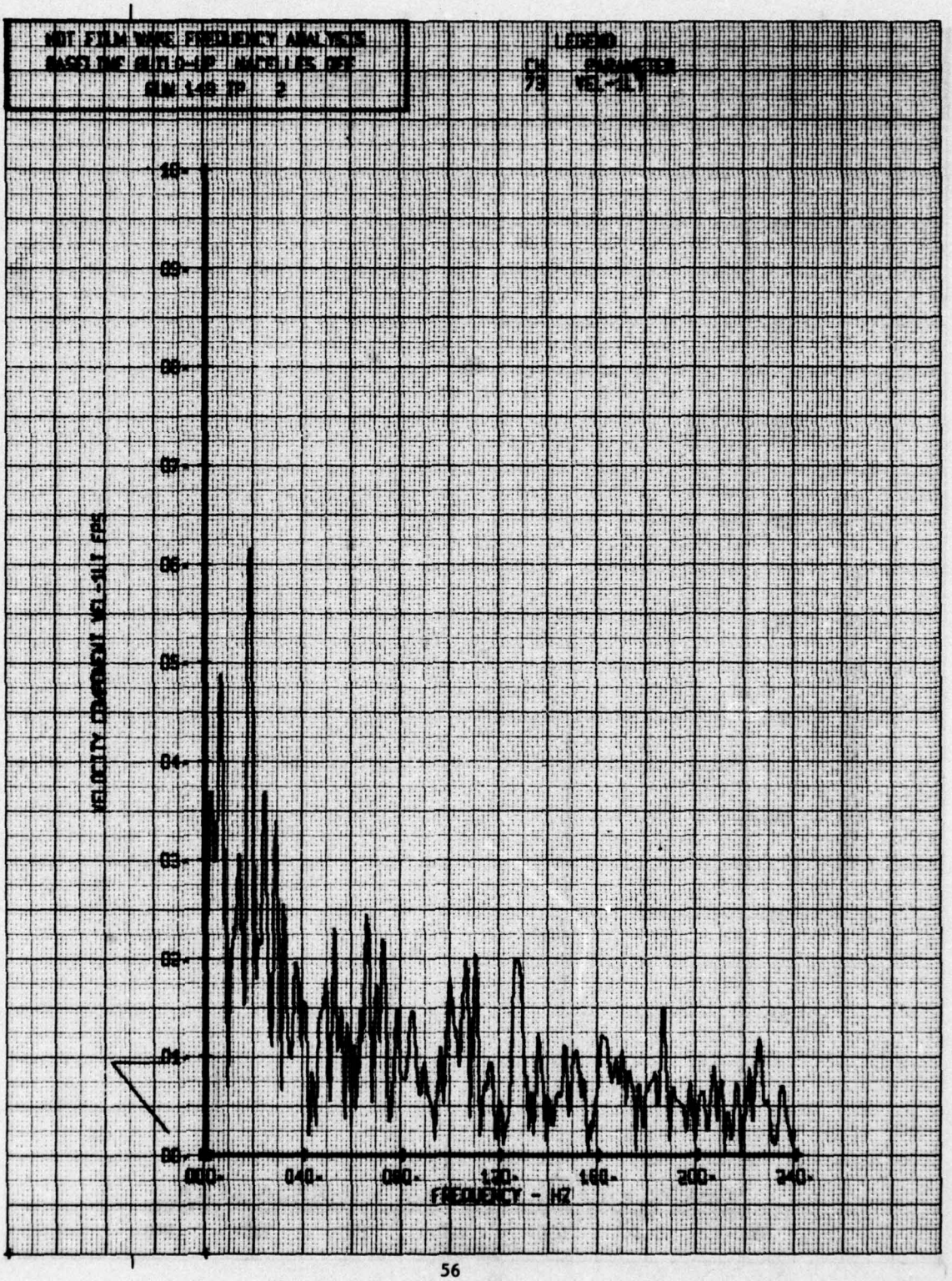

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE SHIELD-UP NACELLES OFF
RUN 149 TP 6
LEGEND
CH PARAMETER
74 VEL-1RT
VELOCITY COMPONENT VEL-1RT FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

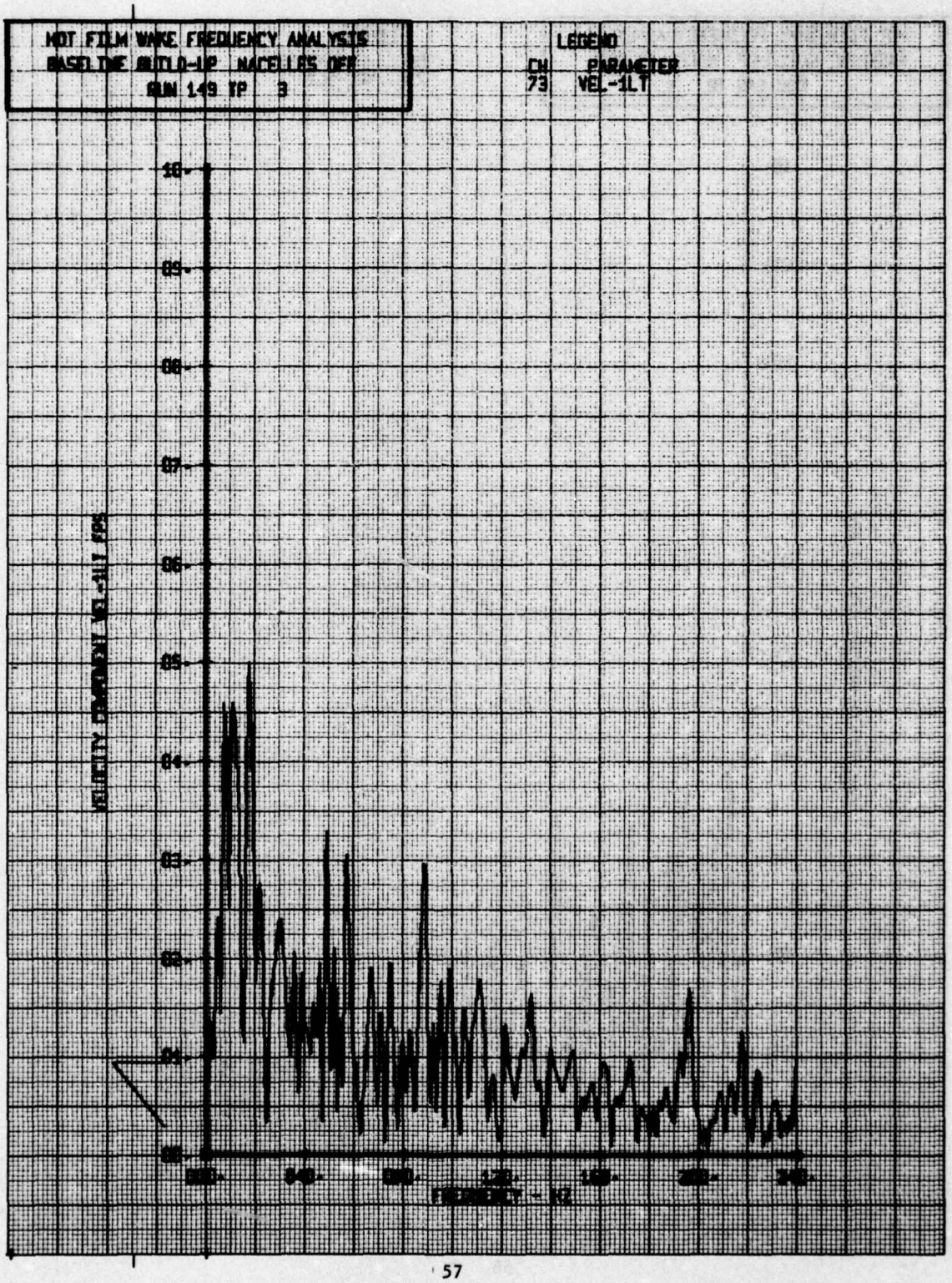

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 149 TP 7
LEGEND
CH PARAMETER
74 VEL-1RT
VELOCITY COMPONENT VEL-1RT FPS
FREQUENCY - HZ

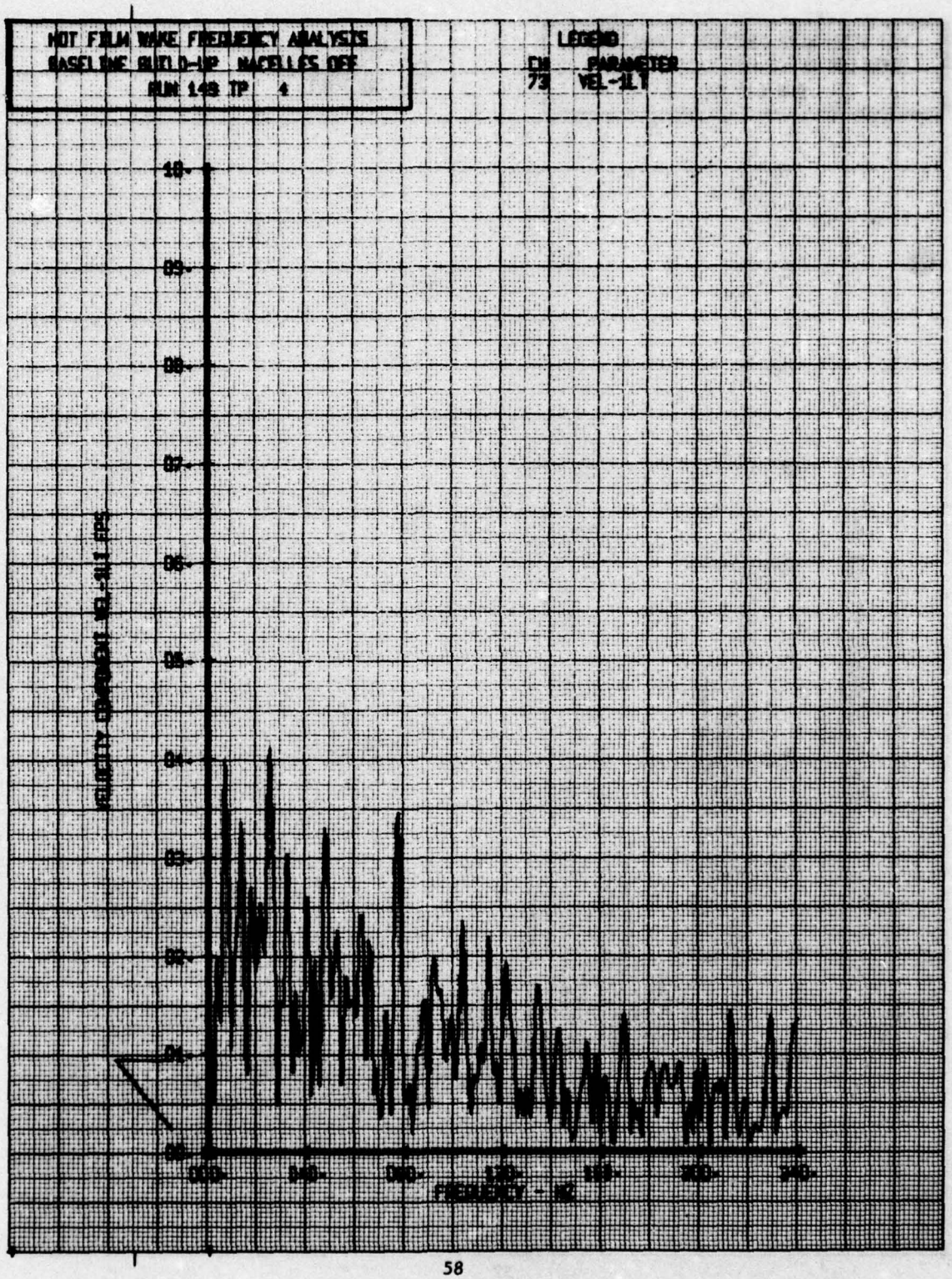

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 8
LEGEND
CH PARAMETER
74 VEL-1RT
VELOCITY COMPONENT VEL-1RT FPS
FREQUENCY - HZ

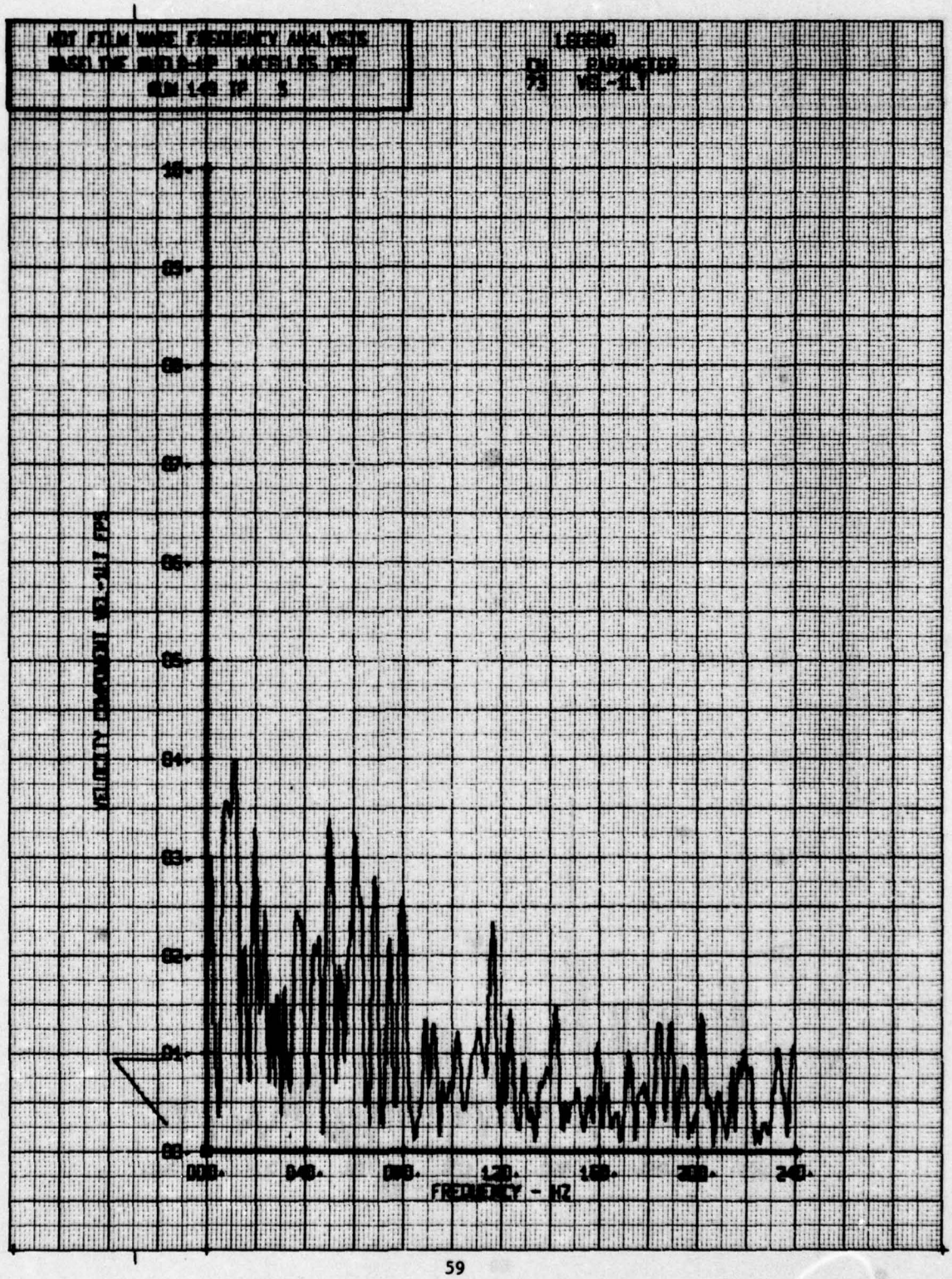

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 YP 9
LEGEND
CH PARAMETER
74 VEL-1RT
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0.0
VELOCITY COMPONENT VEL-1RT FPS
0.0
.40
.80
1.20
1.60
2.00
2.40
FREQUENCY - KZ

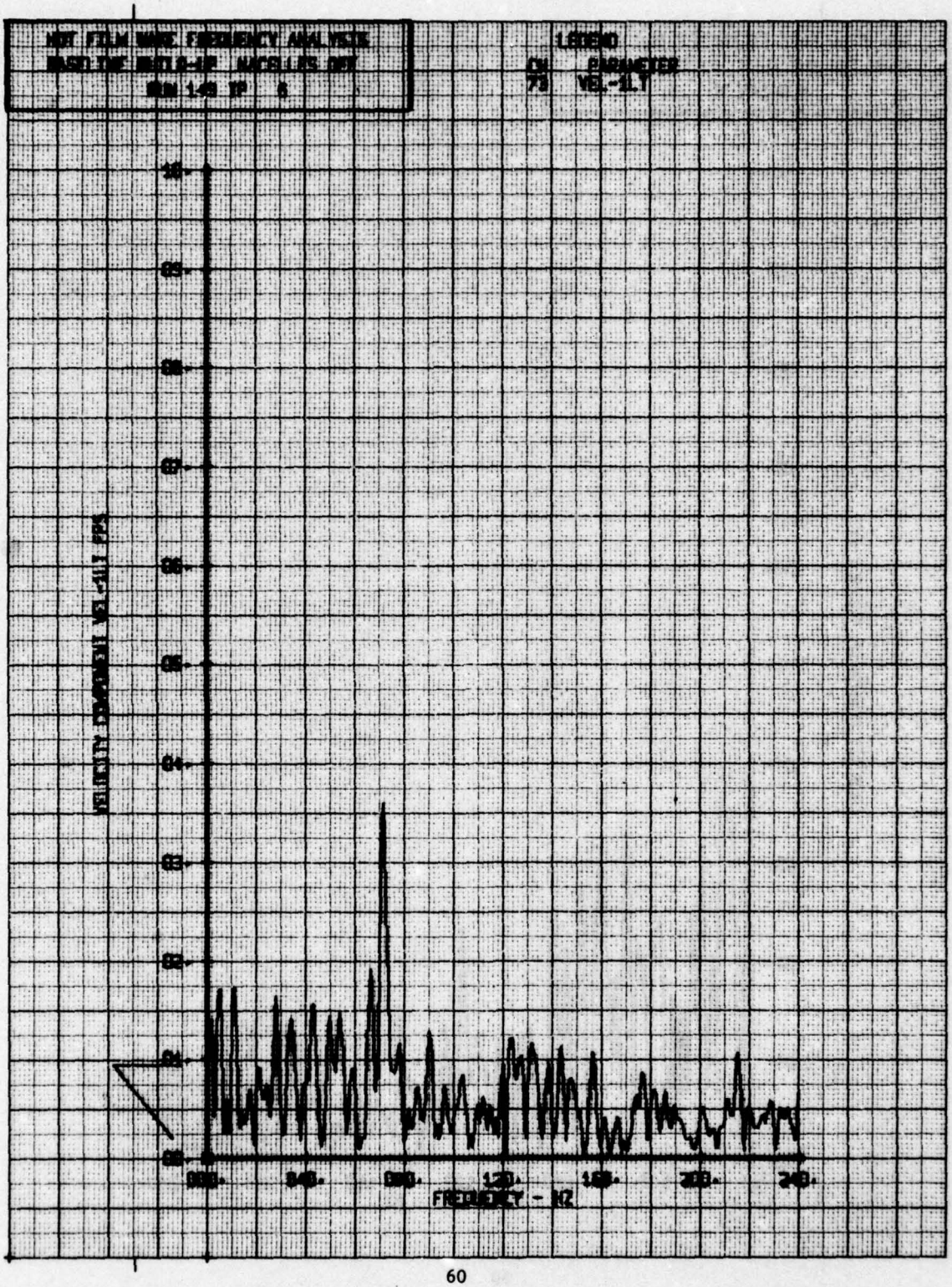

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 149 TP 10
LEGEND
CH PARAMETER
74 VEL.-1RT
VELOCITY COMPONENT VEL-1RT FPS
FREQUENCY - HZ

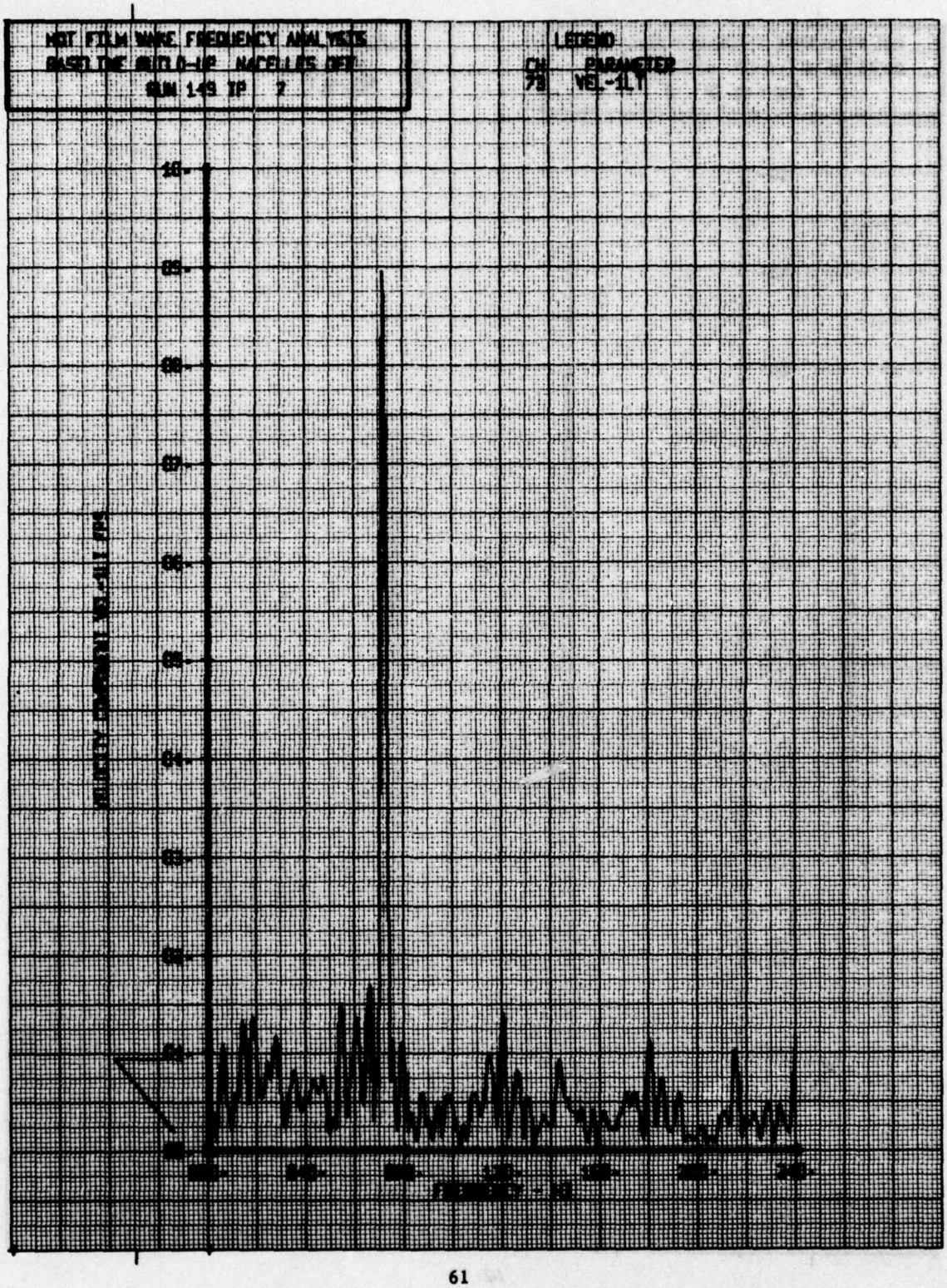

HOT FILM WIRE FREQUENCY ANALYSIS
BASELINE AUTO-SP WAKELESS DET
RUN 148 TP 2
LEGEND
CH PARAMETER
79 VEL-1L
VELOCITY COMPONENT VEL-1L FPS
10-
09-
08-
07-
06-
05-
04-
03-
02-
01-
00-
000-
040-
080-
120-
160-
200-
240-
FREQUENCY - HZ

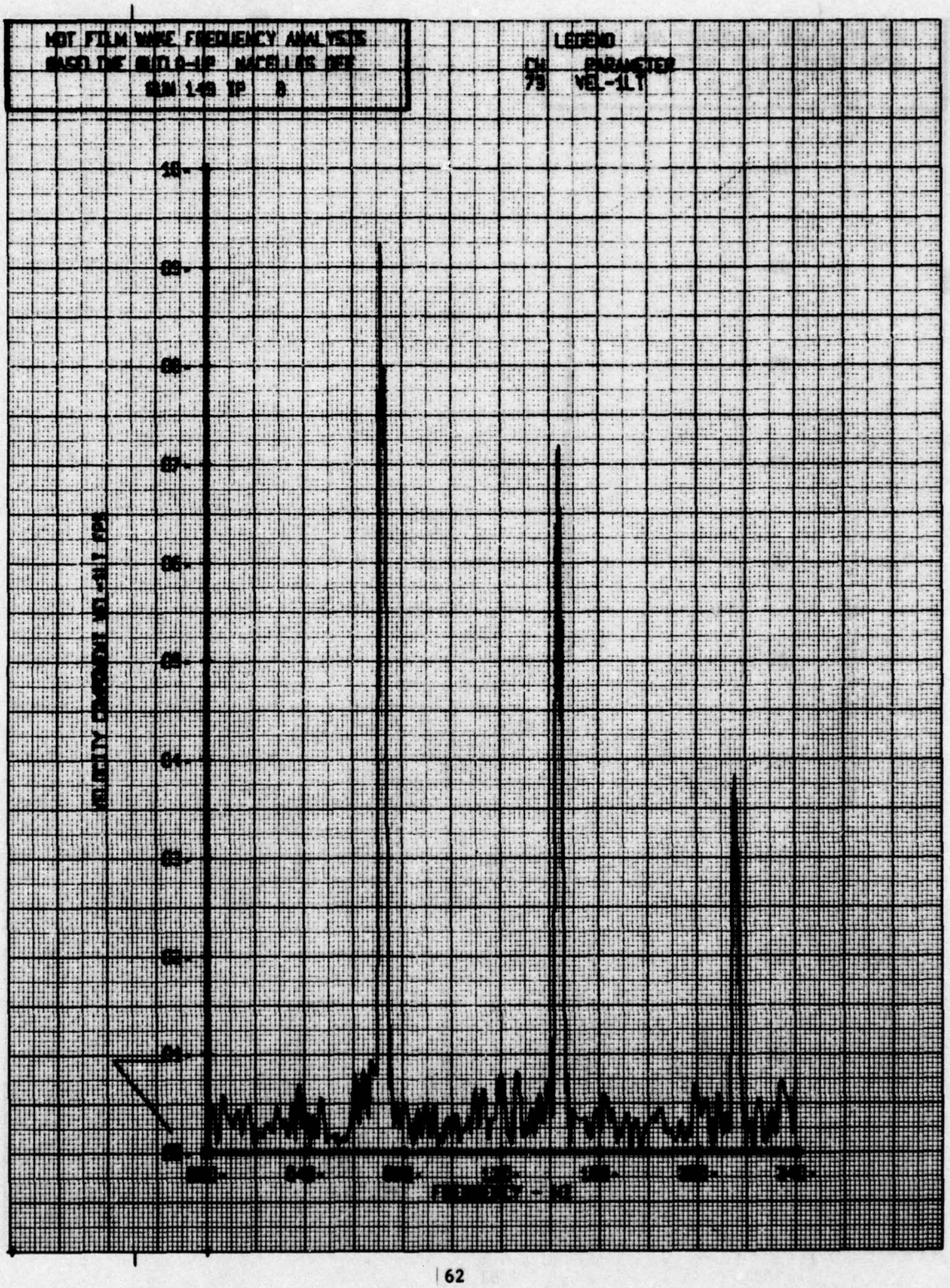

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 3
LEGEND
CH PARAMETER
73 VEL-1LT
10
09
08
07
06
05
04
03
02
01
00
VELOCITY FLUCTUATION VEL-1LT RMS
FREQUENCY - KZ

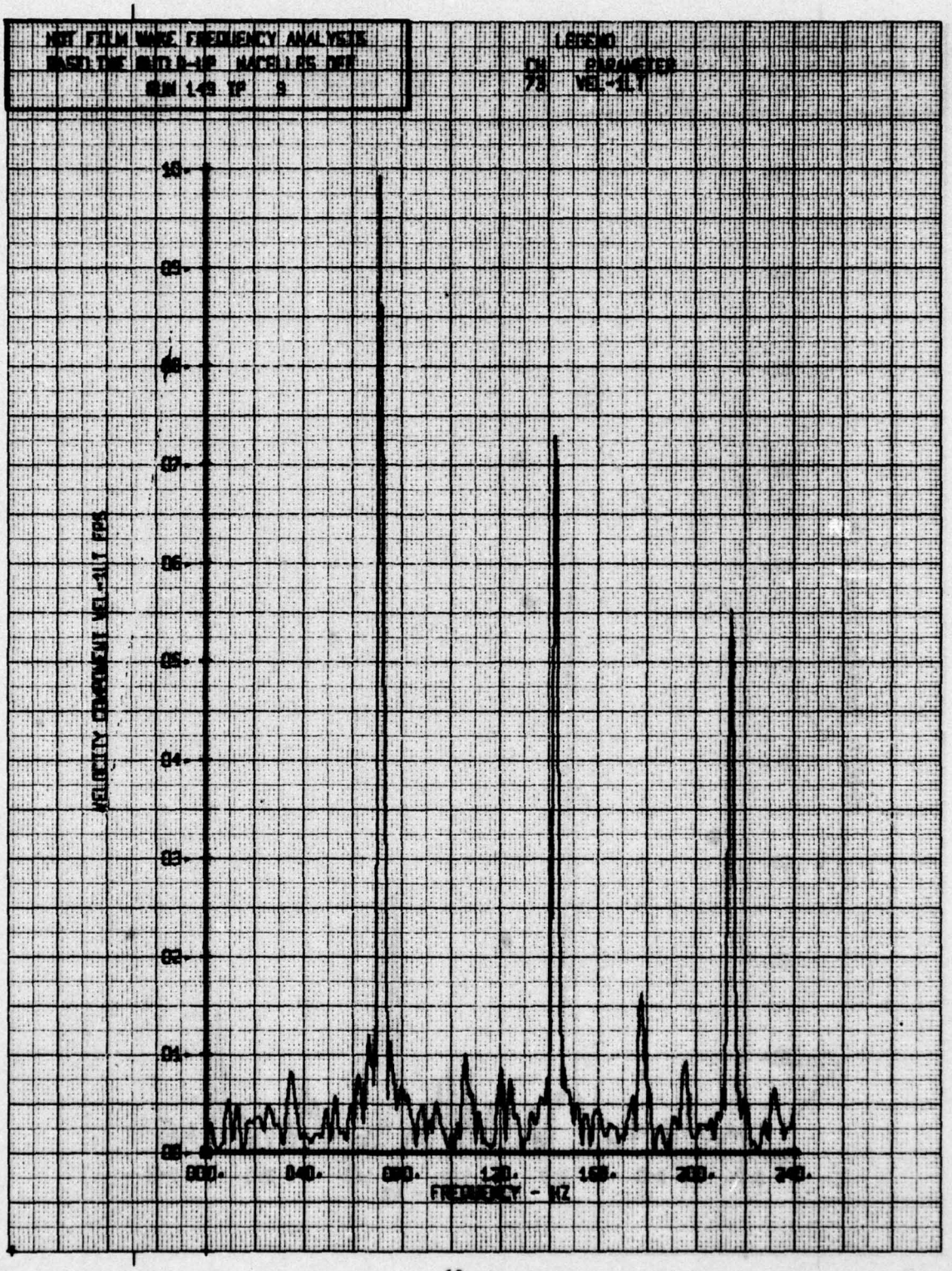

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 4
LEGEND
CH PARAMETER
73 VEL-ILT
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
FREQUENCY - HZ

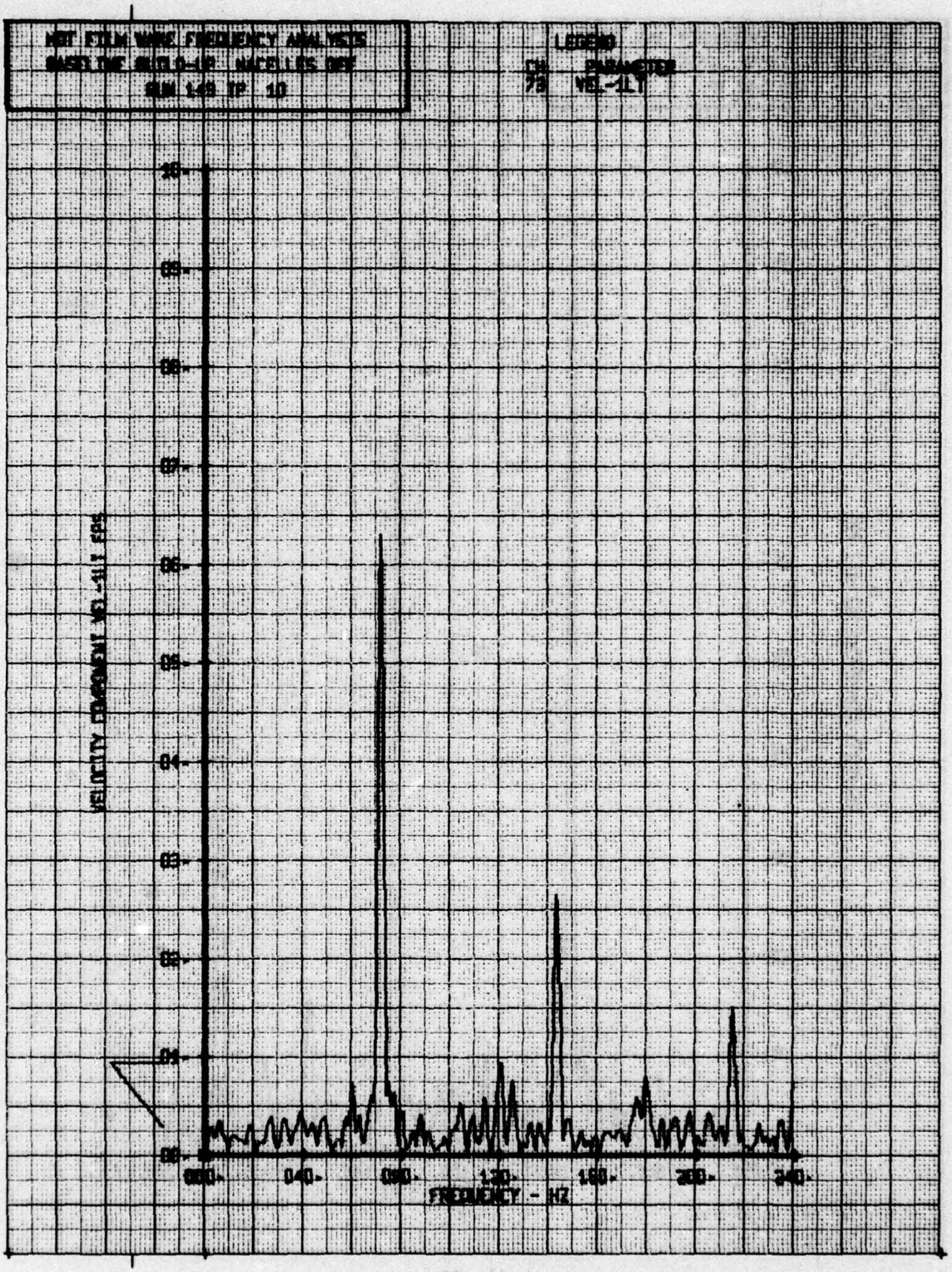

HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
CH PARAMETER
FS VEL-LT
VELOCITY COMPONENT VEL-LT FPS
FREQUENCY - HZ

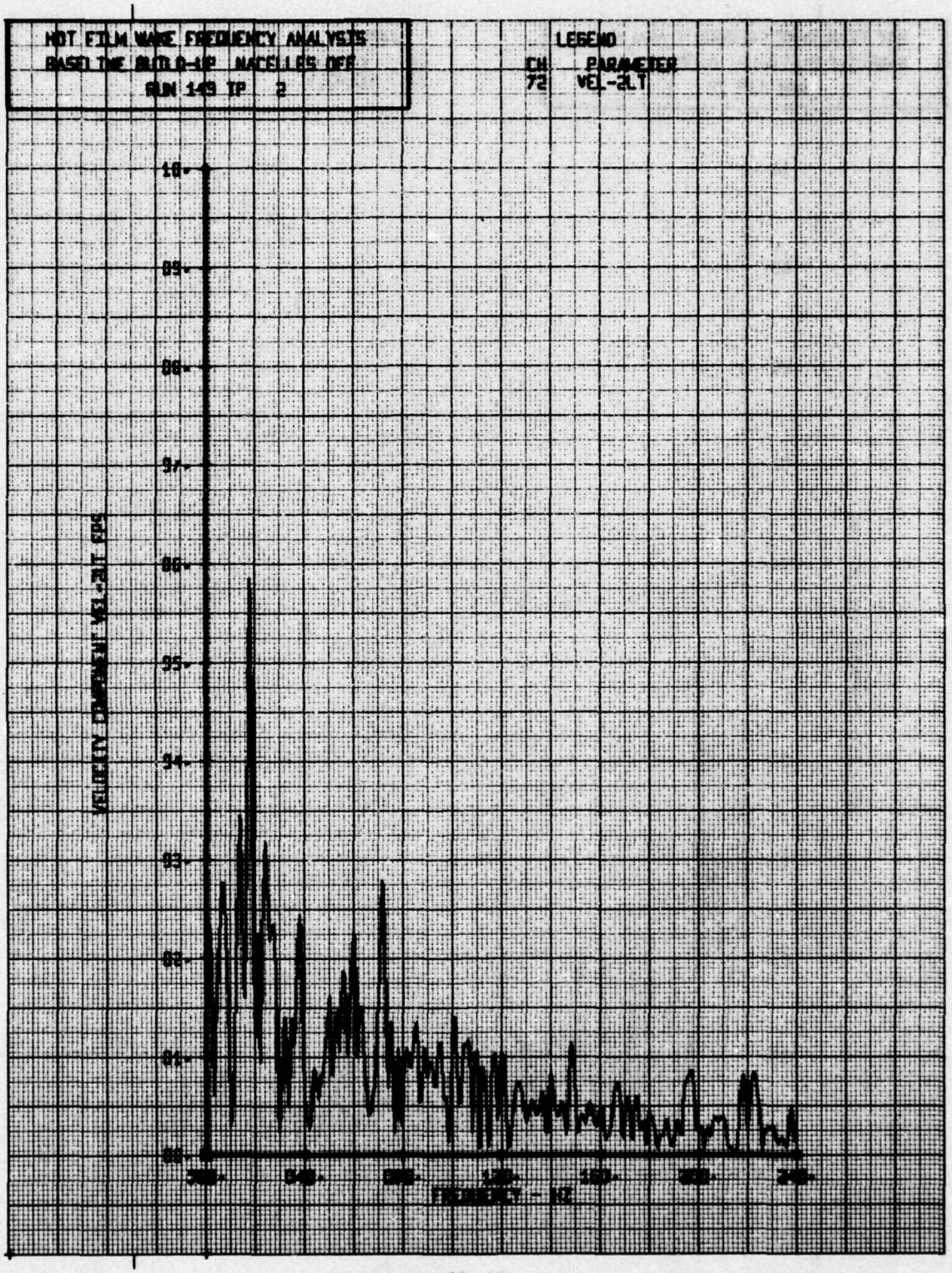

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 149 TP 6
LEGEND
CH PARAMETER
73 VEL-ELY
FREQUENCY - HZ

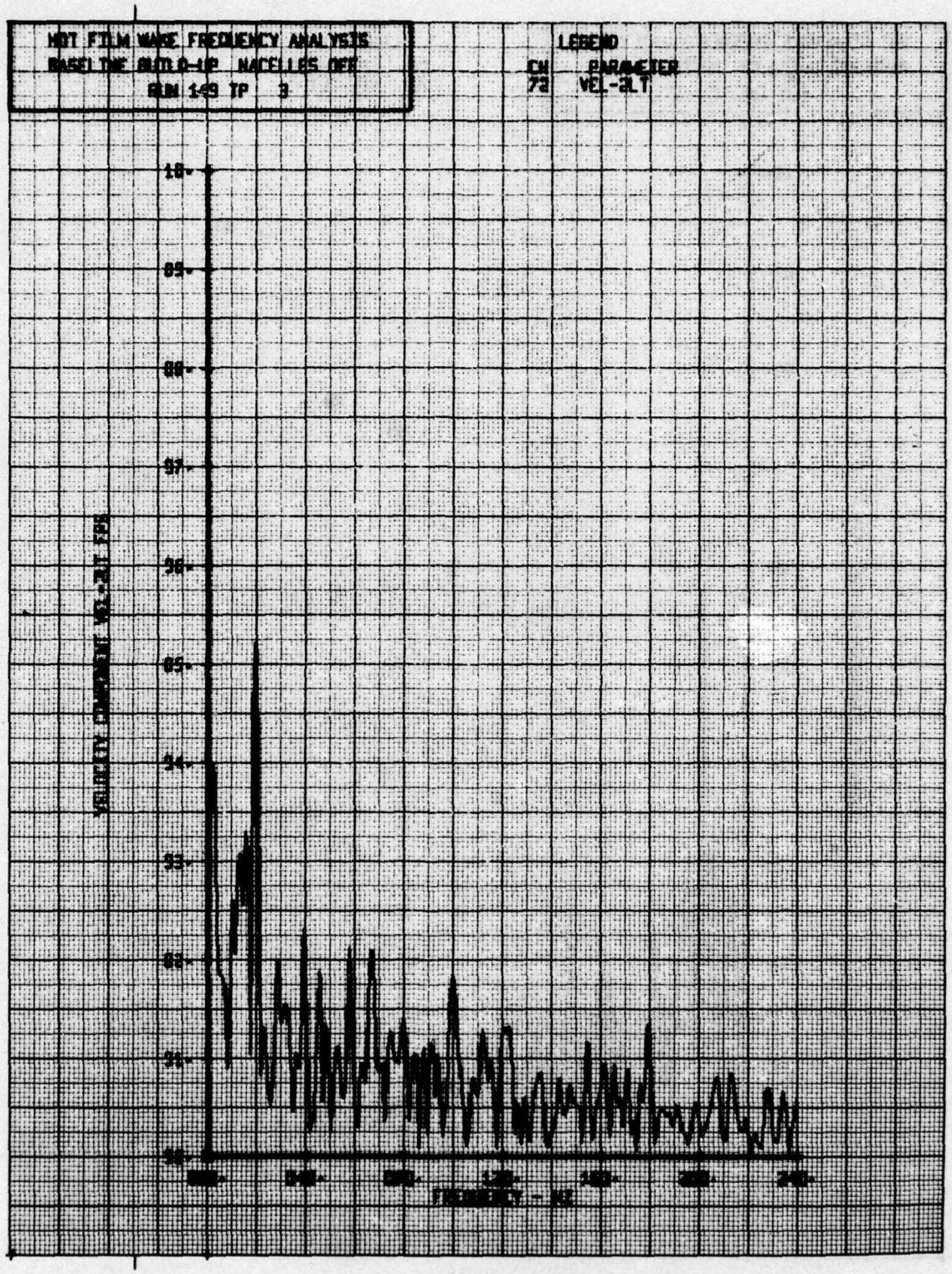

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 149 TP 2
LEGEND
CH PARAMETER
79 VEL-1LT

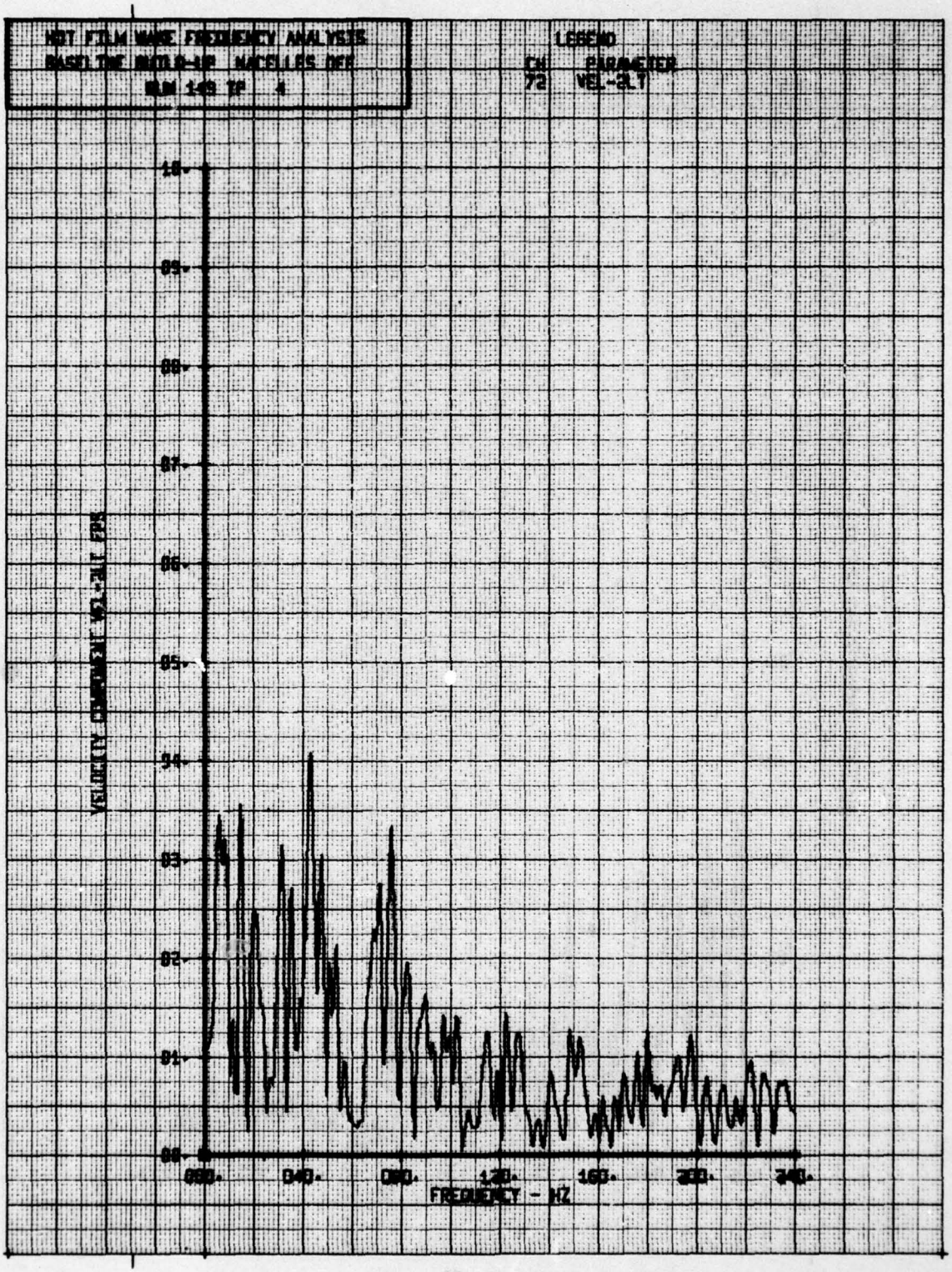

HOT FILM WIRE FREQUENCY ANALYSIS
LEGEND
CH PARAMETER
79 VEL-1LT

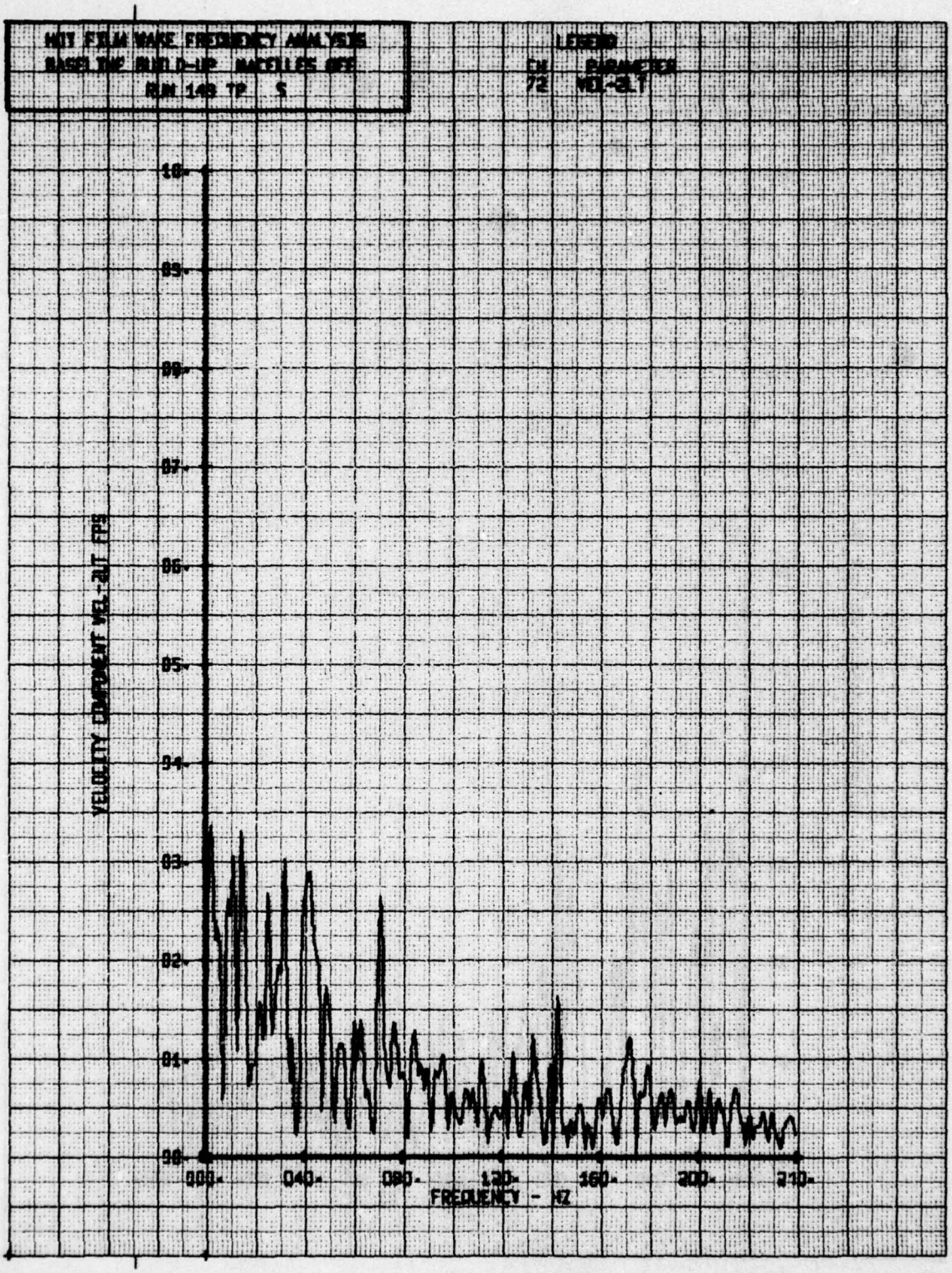

NPT FLUM WAKE FREQUENCY ANALYSIS
LEGEND
CH PARAMETER
75 VEL-1L.Y
VELOCITY CONSTANT VEL-1LT FPS
FREQUENCY - HZ

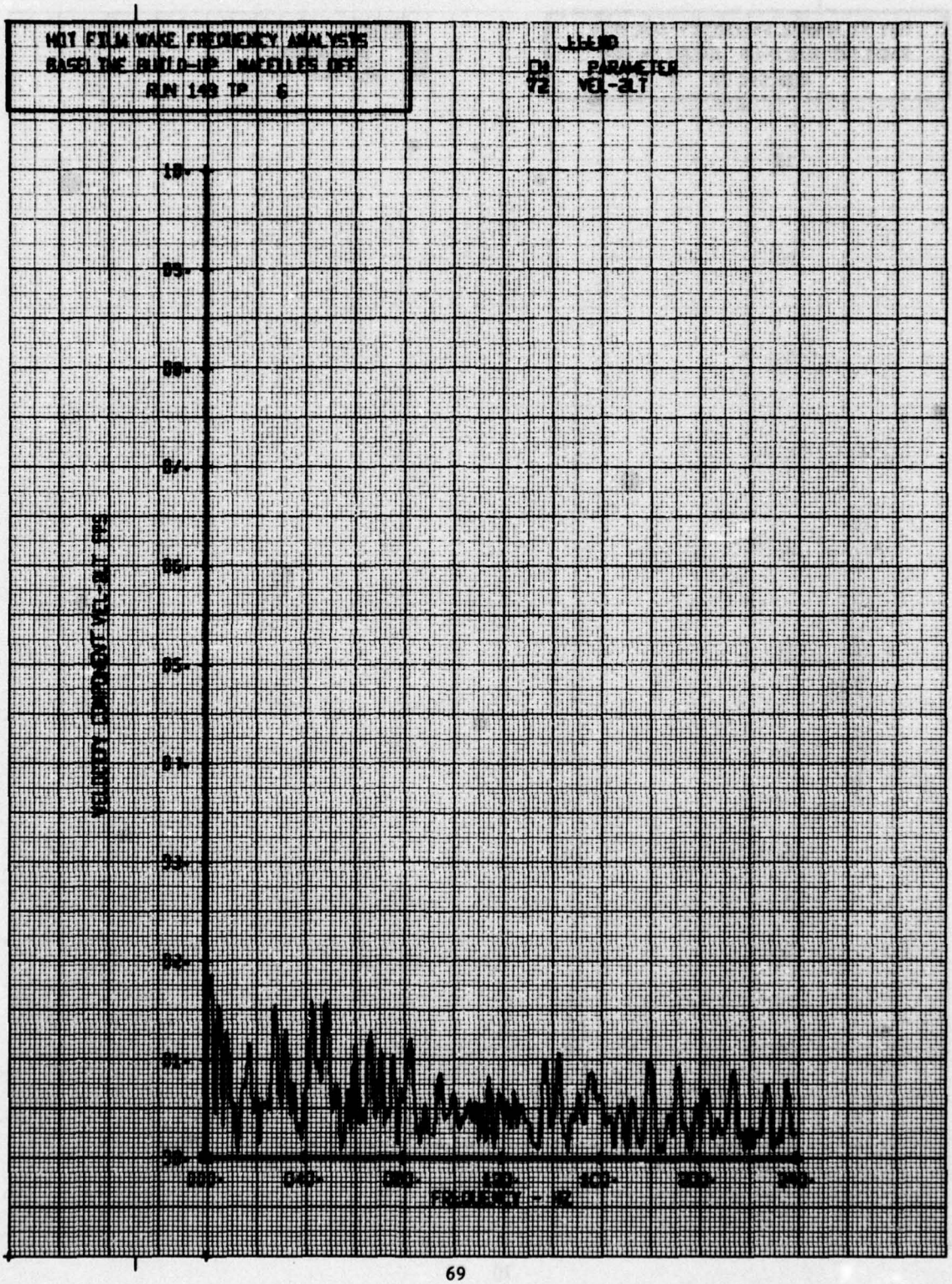

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 148 TP 10
LEGEND
CH PARAMETER
79 VEL-1LT
VELOCITY COMPONENT VEL-1LT FPS
FREQUENCY - HZ

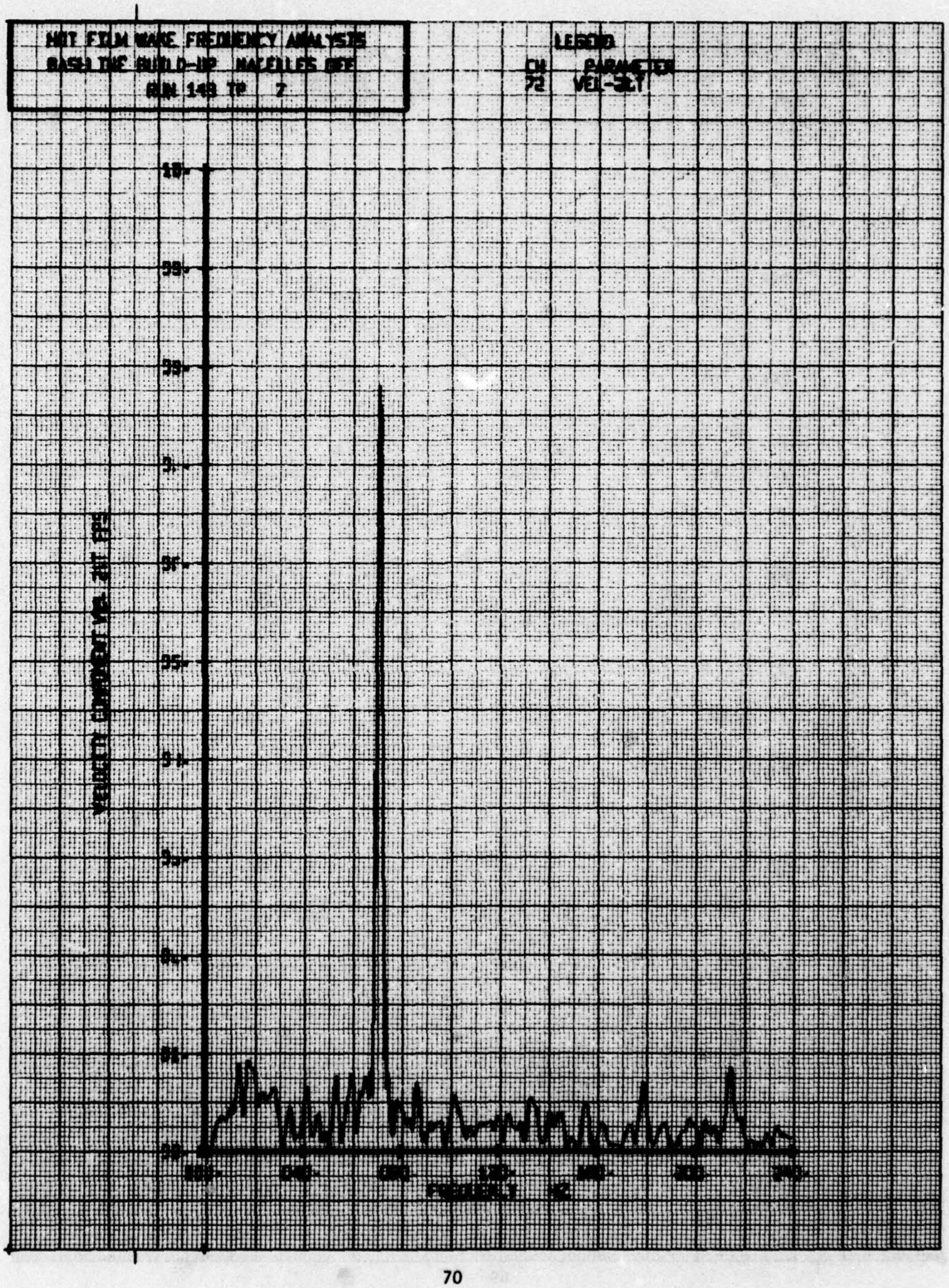

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 143 TP 2
LEGEND
CH PARAMETER
72 VEL-2LT
VELOCITY COMPONENT VEL-2LT FPS
FREQUENCY - HZ

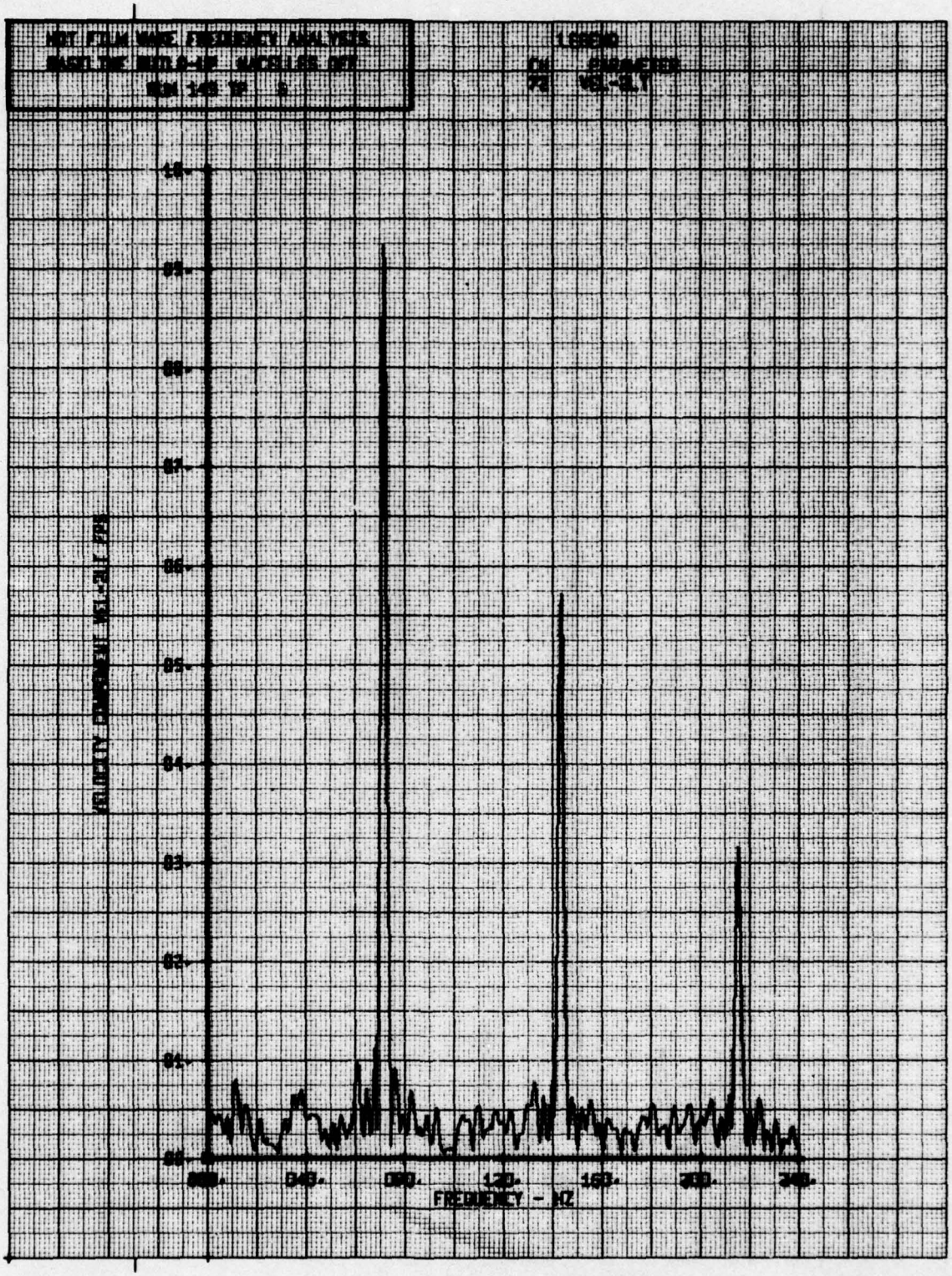

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BLOCK-UP NACELLES OFF
RUN 149 TP 3
LEGEND
CH PARAMETER
72 VEL-2LT
VELOCITY COMPONENT VEL-2LT FPS
FREQUENCY - HZ

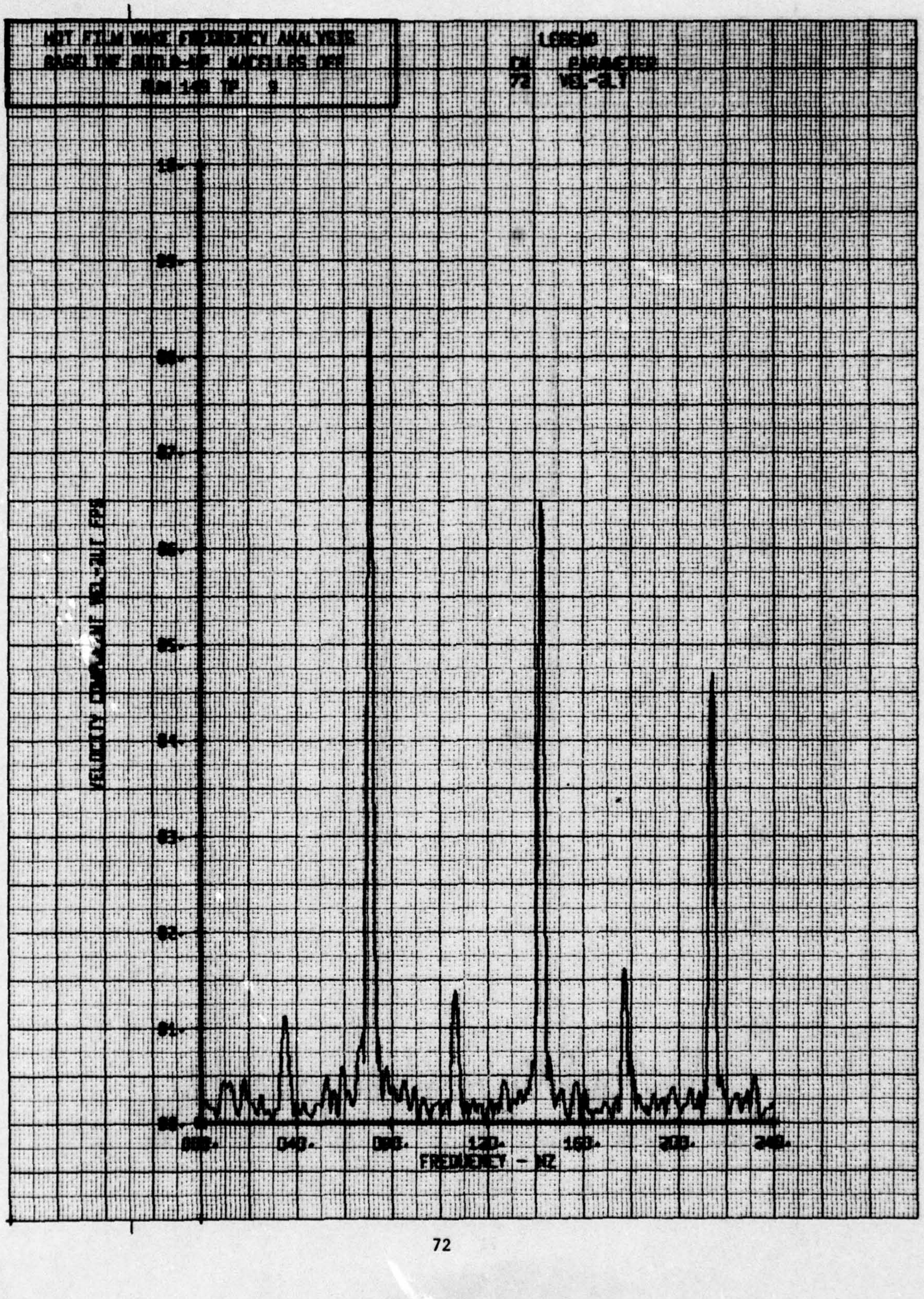

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE WITH R-UP NACELLES OFF
RUN 149 TP 4
LEGEND
CH PARAMETER
72 VEL-2LT
VELOCITY COMPONENT VEL-2LT FPS
FREQUENCY - HZ

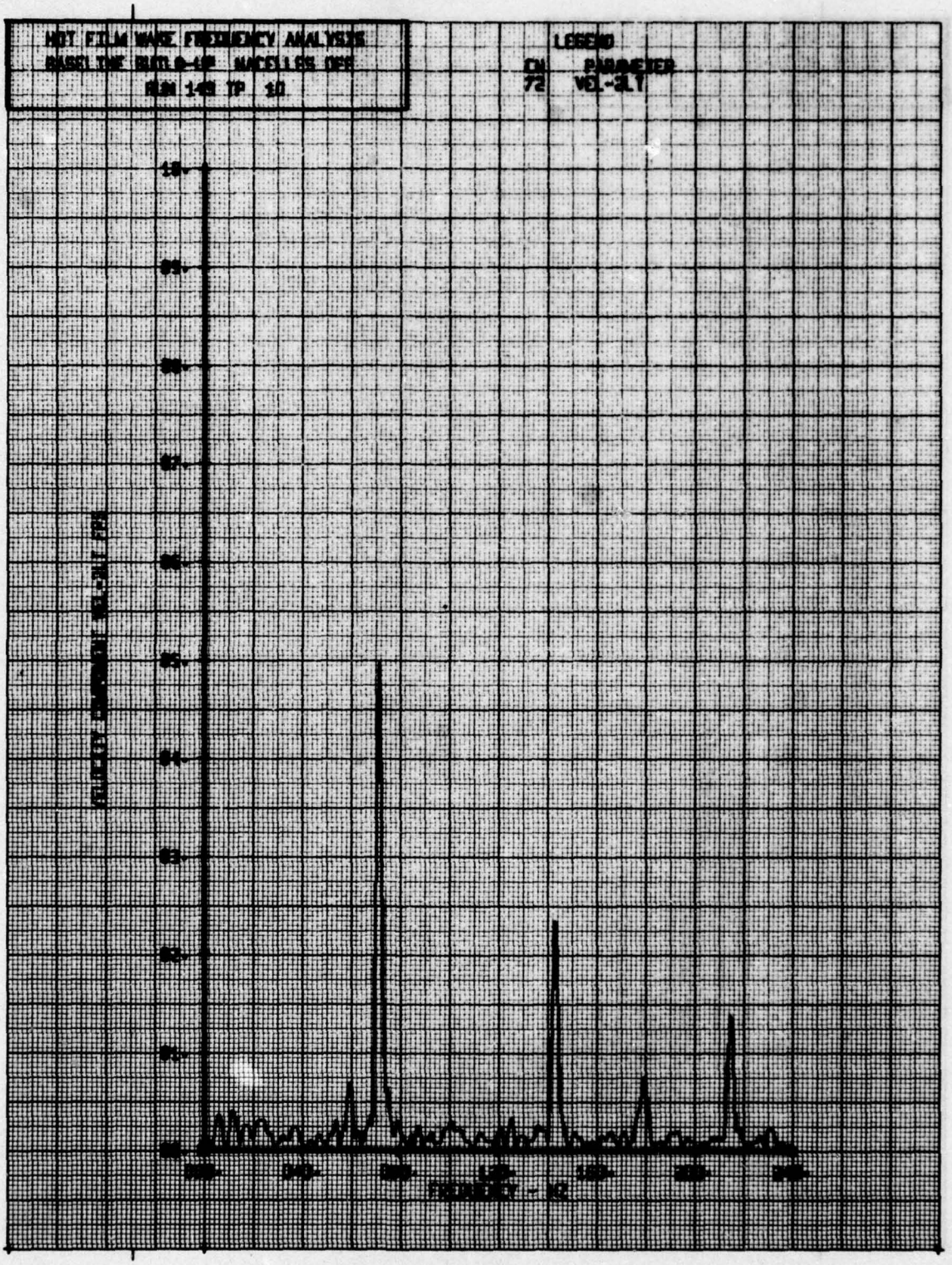

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 5
LEGEND
CH PARAMETER
72 VEL-2LT
VELOCITY COMPONENT VEL-2LT FPS
100
090
080
070
060
050
040
030
000
040
080
120
160
200
240
FREQUENCY - HZ

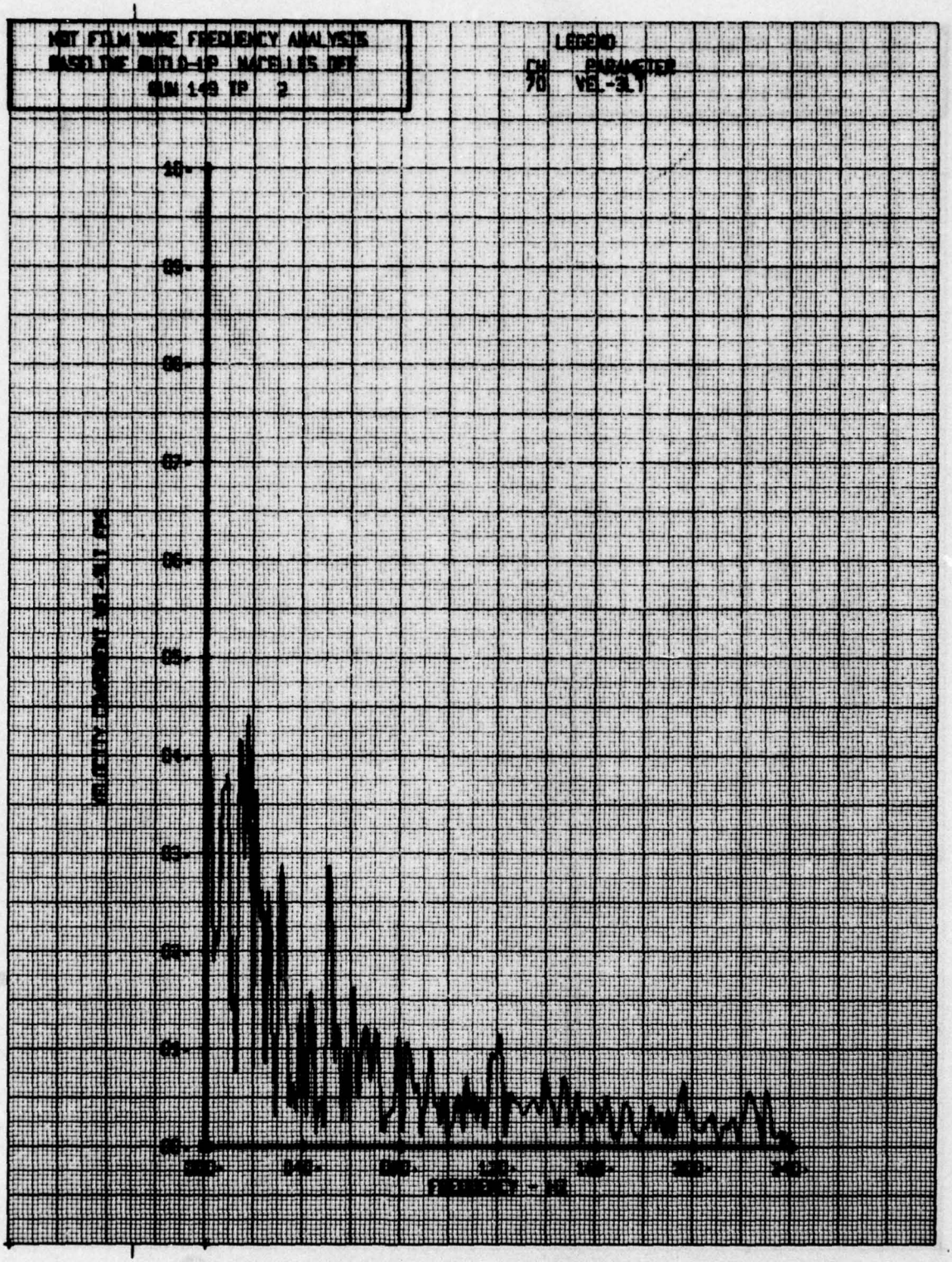

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP MACHLESS OFF
RUN 149 TP 6
LIQUID
CH PARAMETER
72 VEL-ALT
VELOCITY COMPONENT VEL-ALT FPS
FREQUENCY - HZ

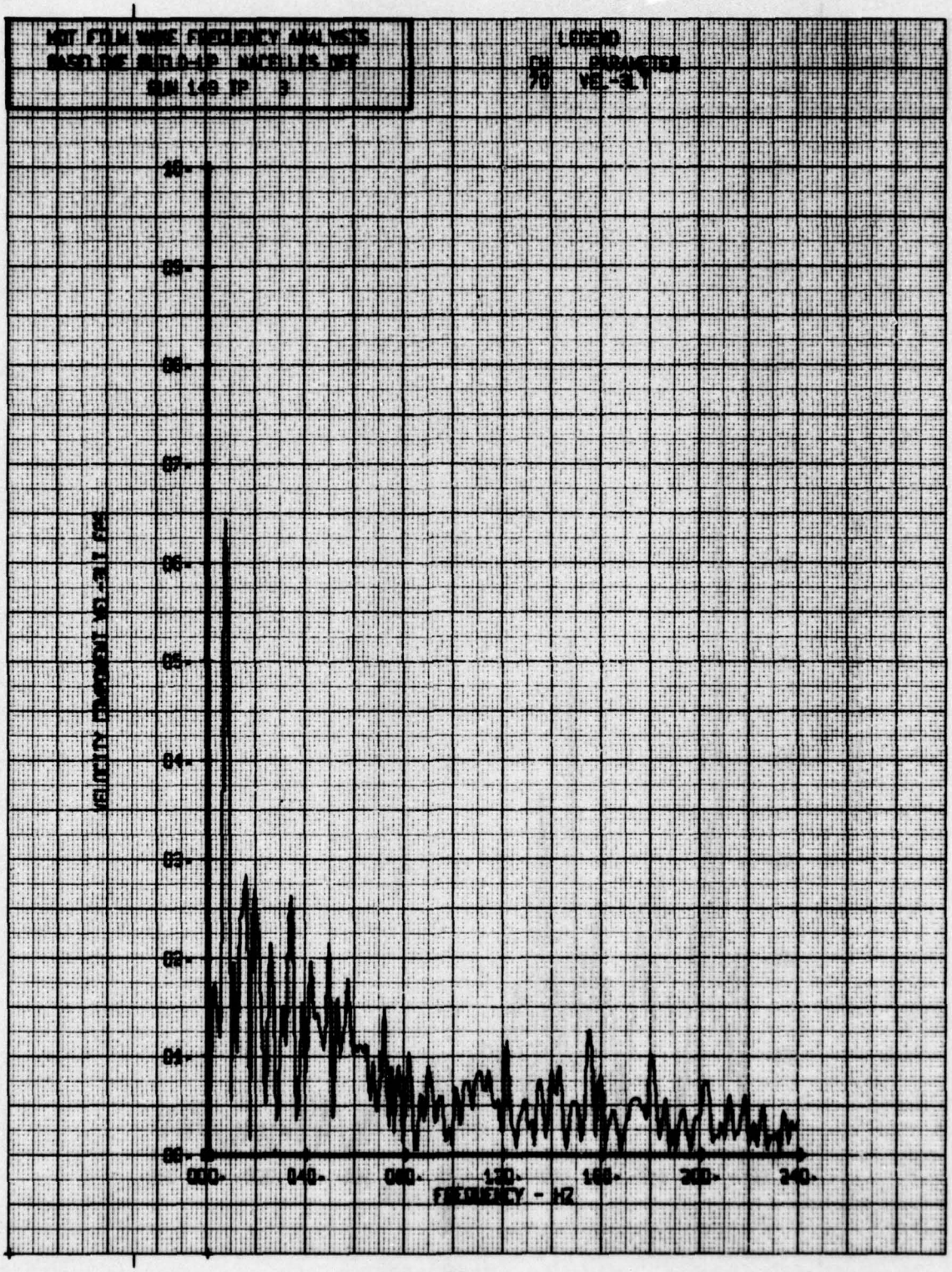

HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
CH PARAMETER
72

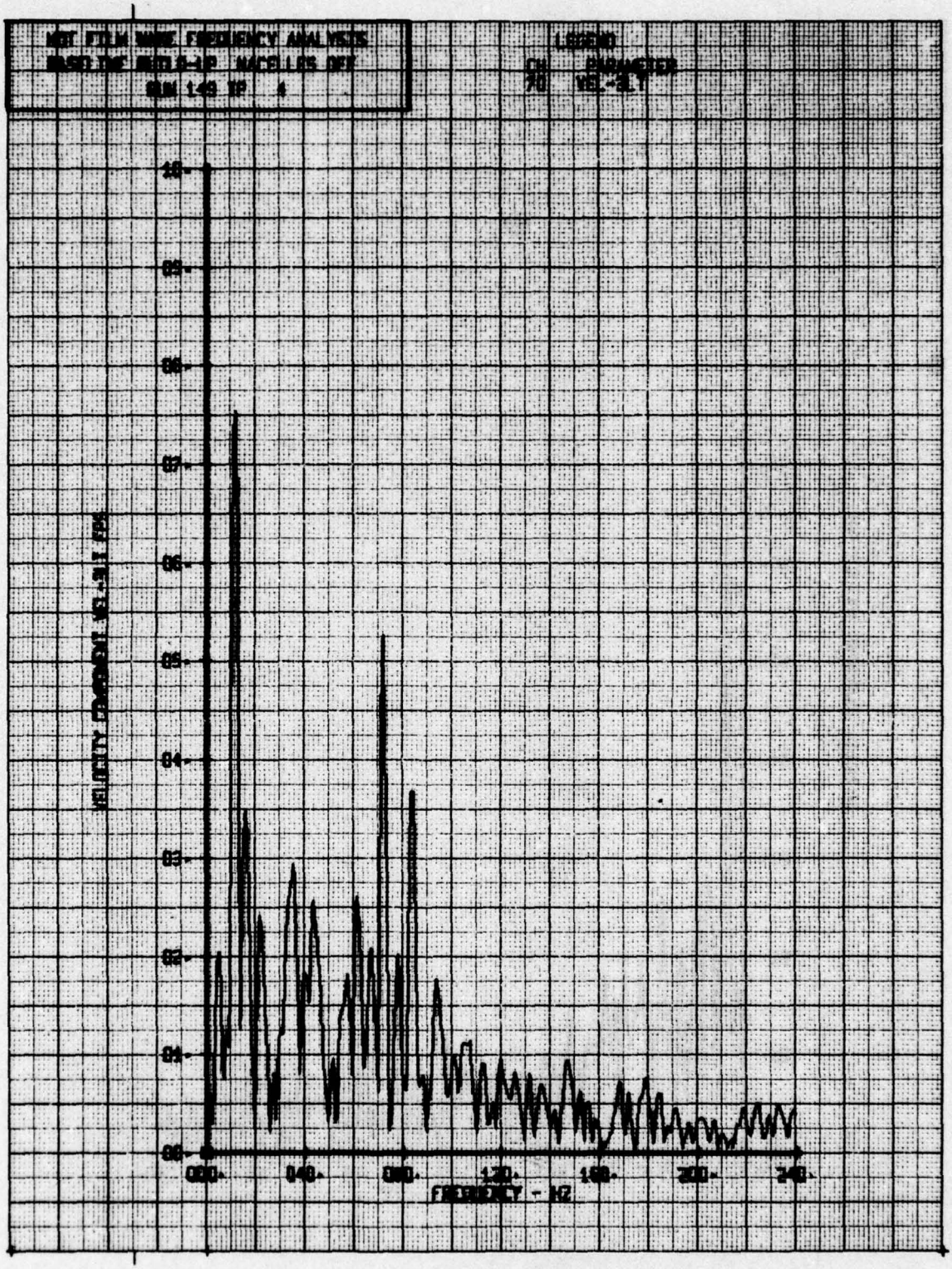

FREQUENCY - HZ

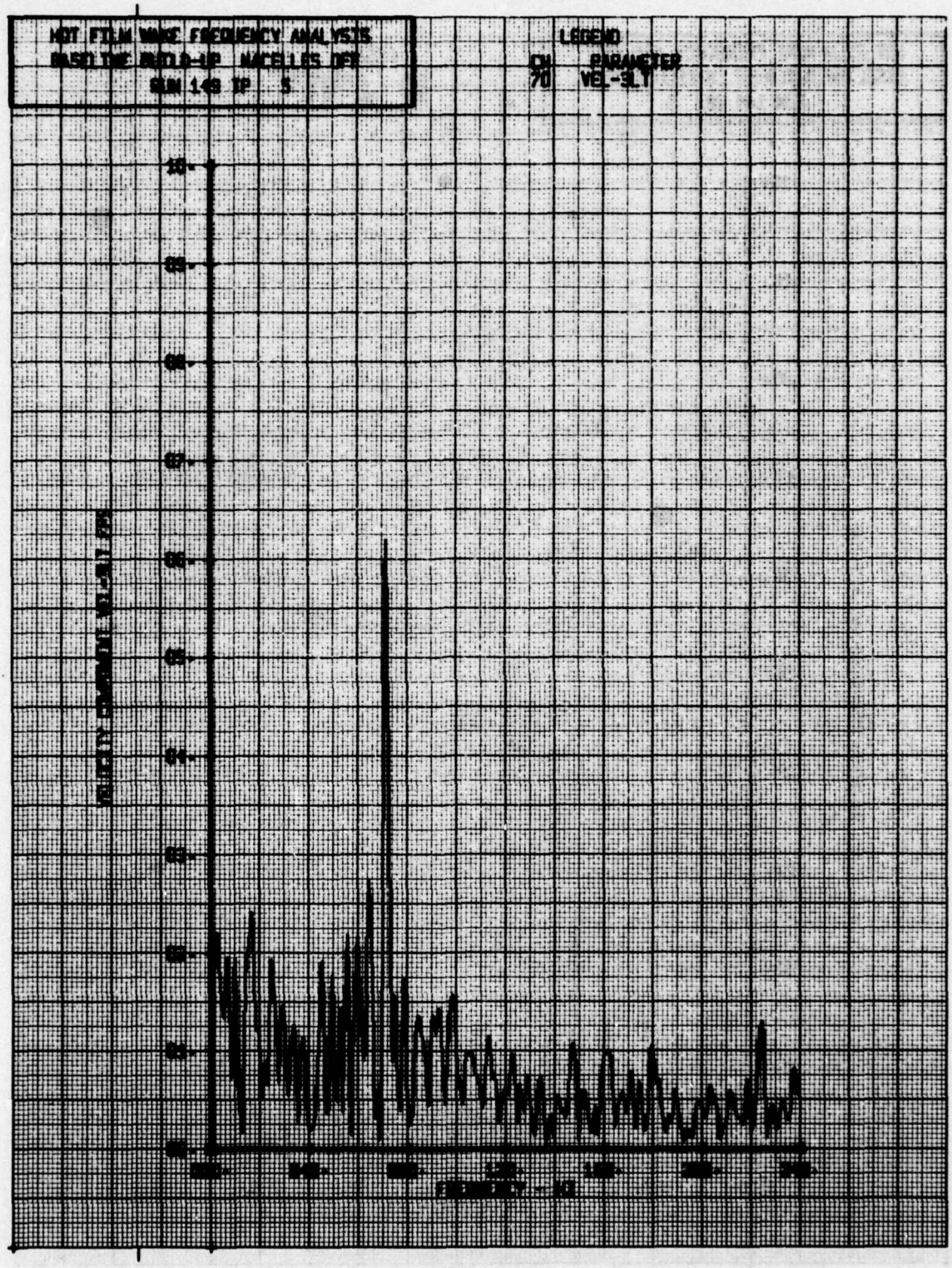

HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
FREQUENCY - HZ

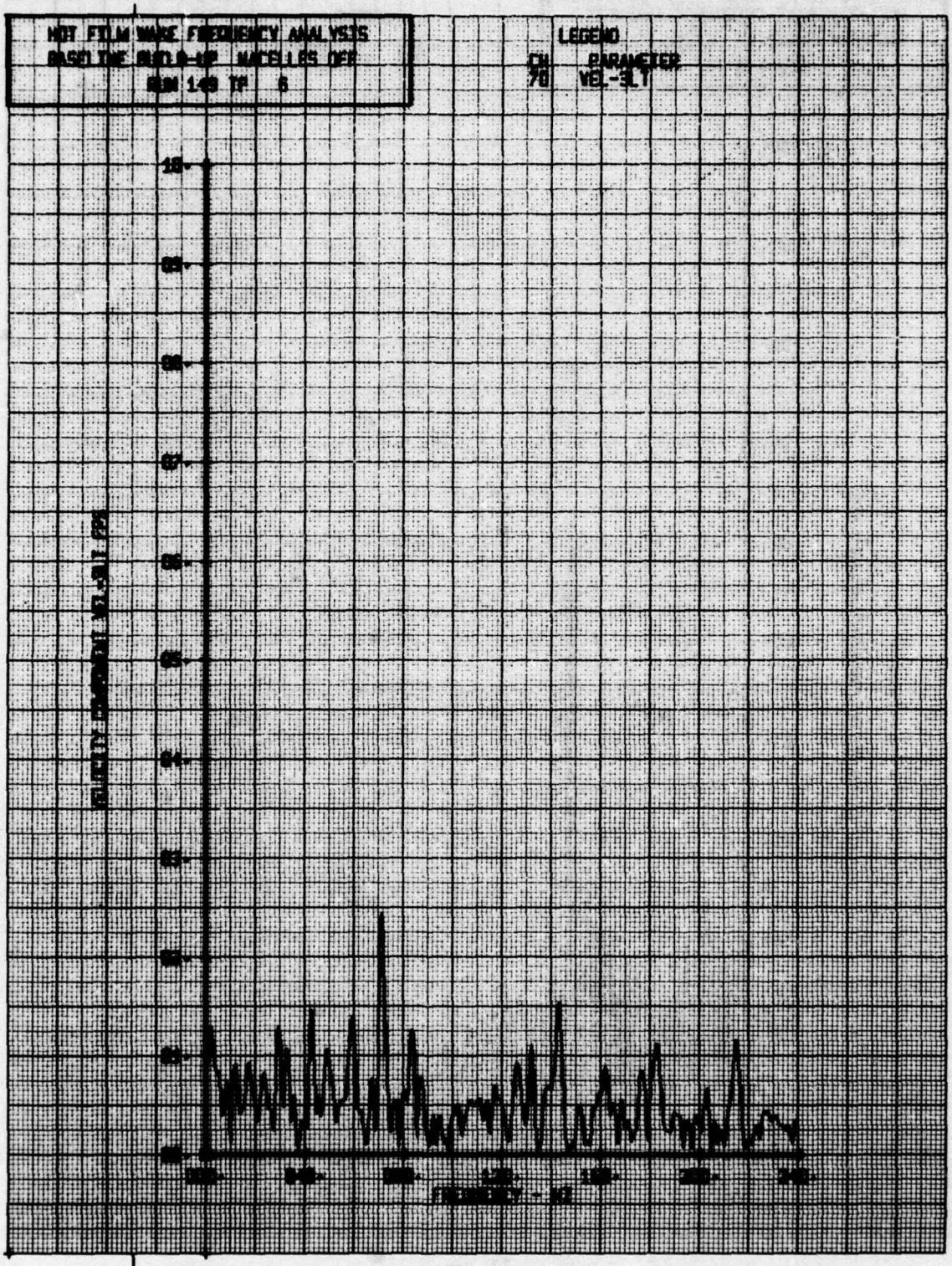

HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
CH PARAMETER
72 VEL-ALT
FREQUENCY - HZ

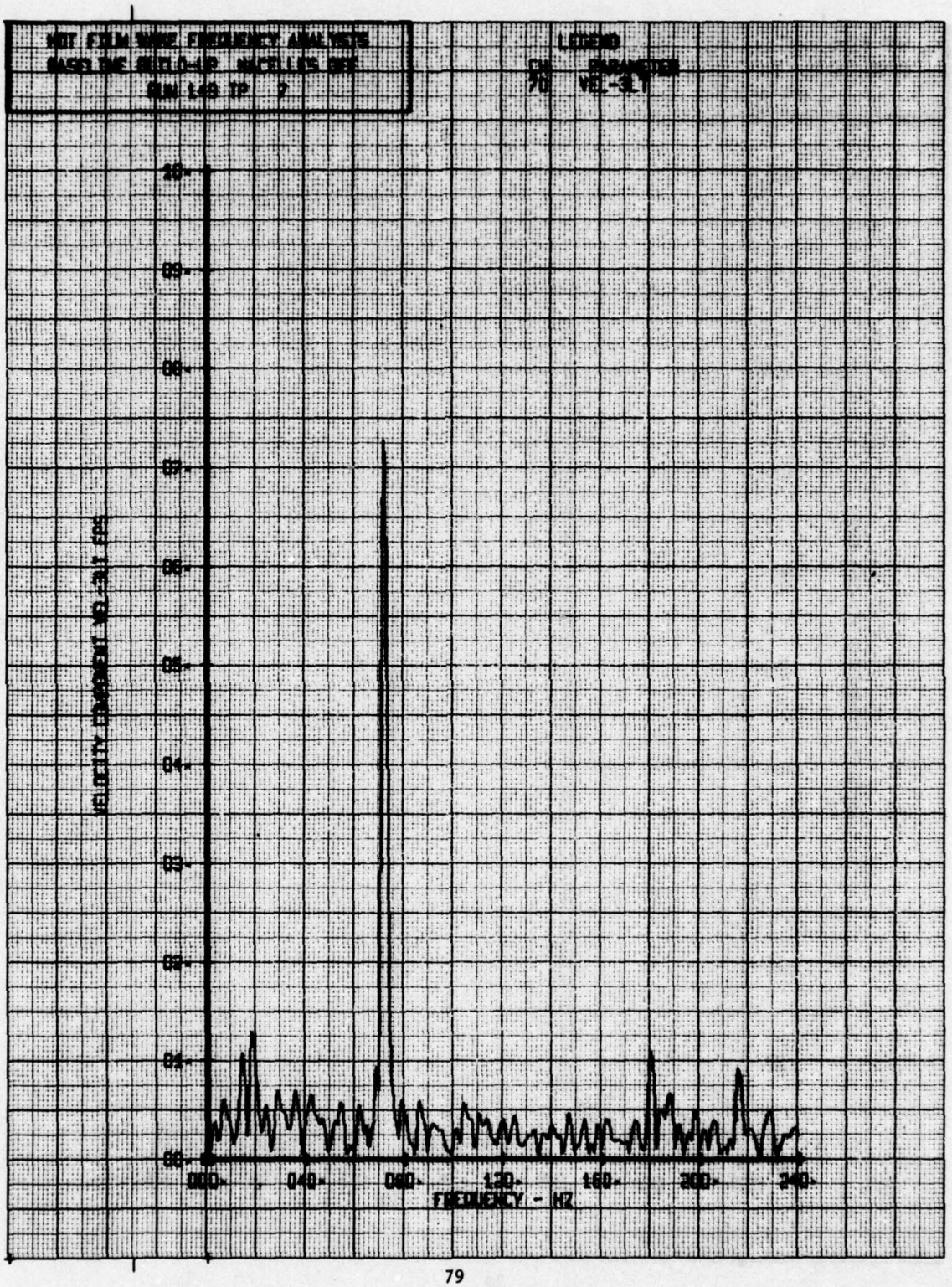

HOT FILM WAKE FREQUENCY ANALYSIS
BASED TIME AUTO-UP NACELLES OFF
RUN 149 TP 2
LEGEND
CH PARAMETER
70 VEL-3L
100
90
80
70
60
50
40
30
20
10
0
FREQUENCY - HZ

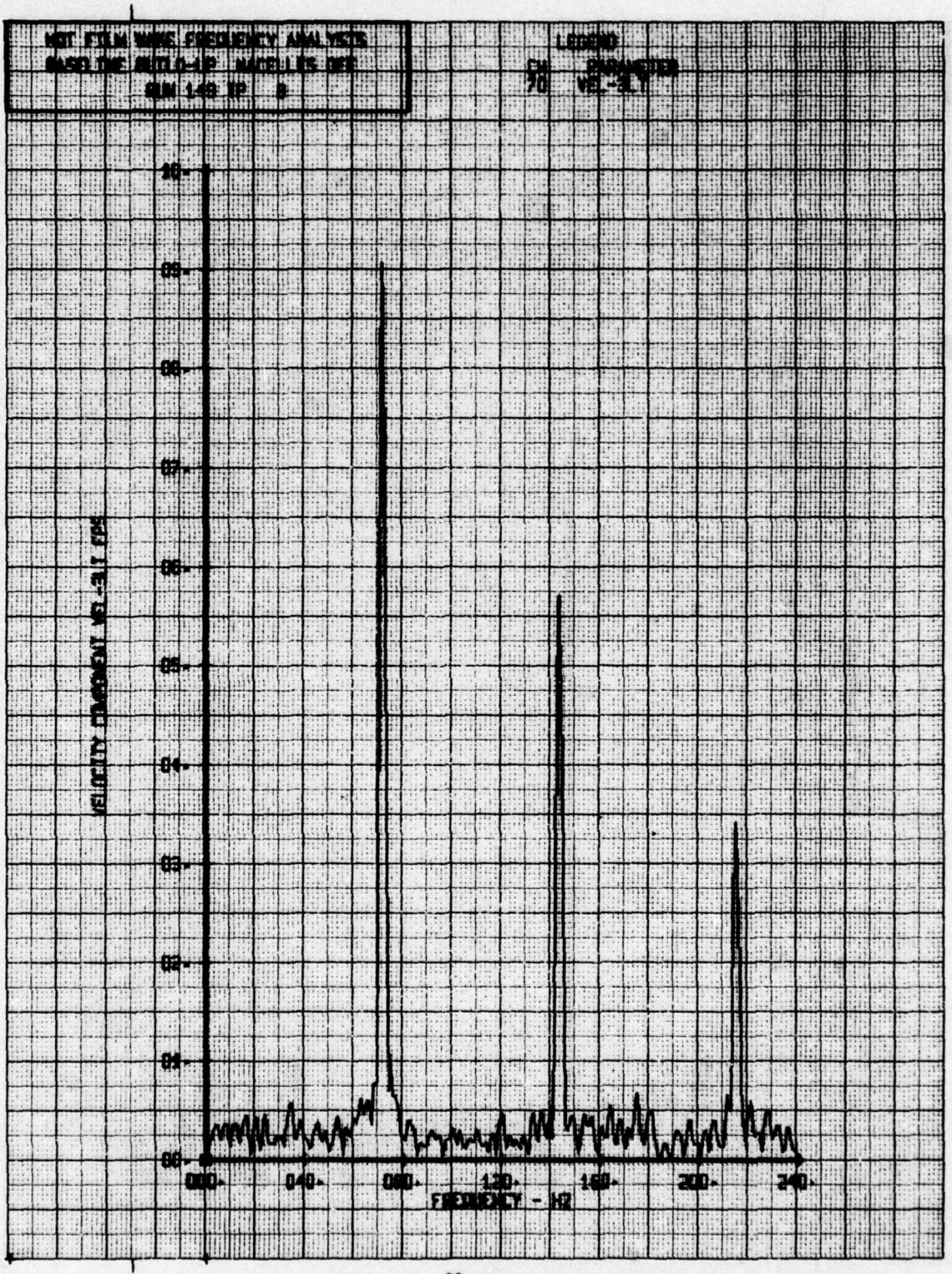

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 148 TP 3
LOCUS
70 VEL-3.T
10-
09-
08-
07-
06-
05-
04-
03-
02-
01-
00-
000-
040-
080-
120-
160-
200-
240-
FREQUENCY - HZ

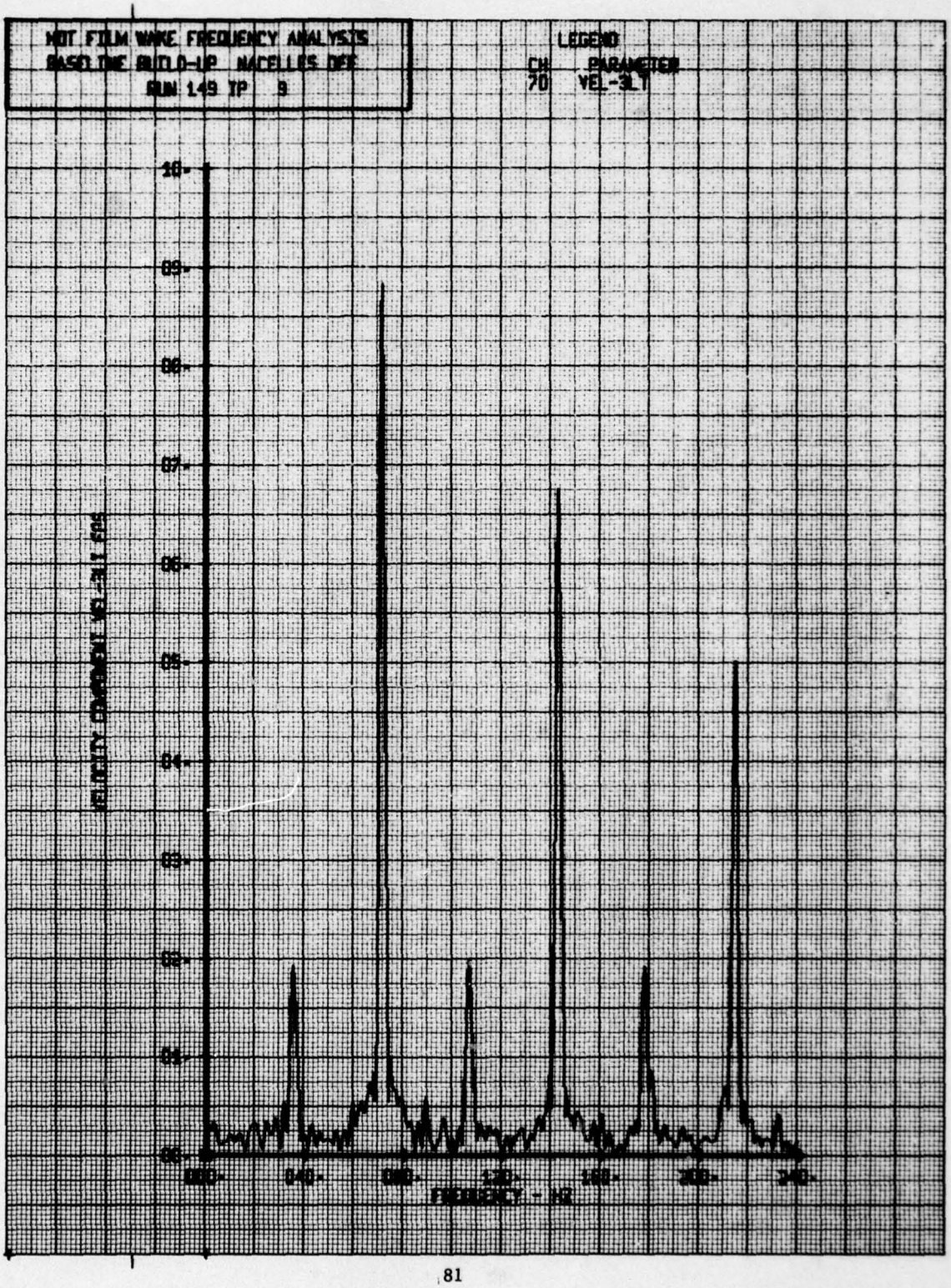

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 149 TP 4
LEGEND
CH PARAMETER
70 VEL-2.T
.10-
.09-
.08-
.07-
.06-
.05-
.04-
.03-
.02-
.01-
.00-
020.
040.
060.
080.
100.
120.
140.
160.
180.
200.
220.
240.
FREQUENCY - HZ

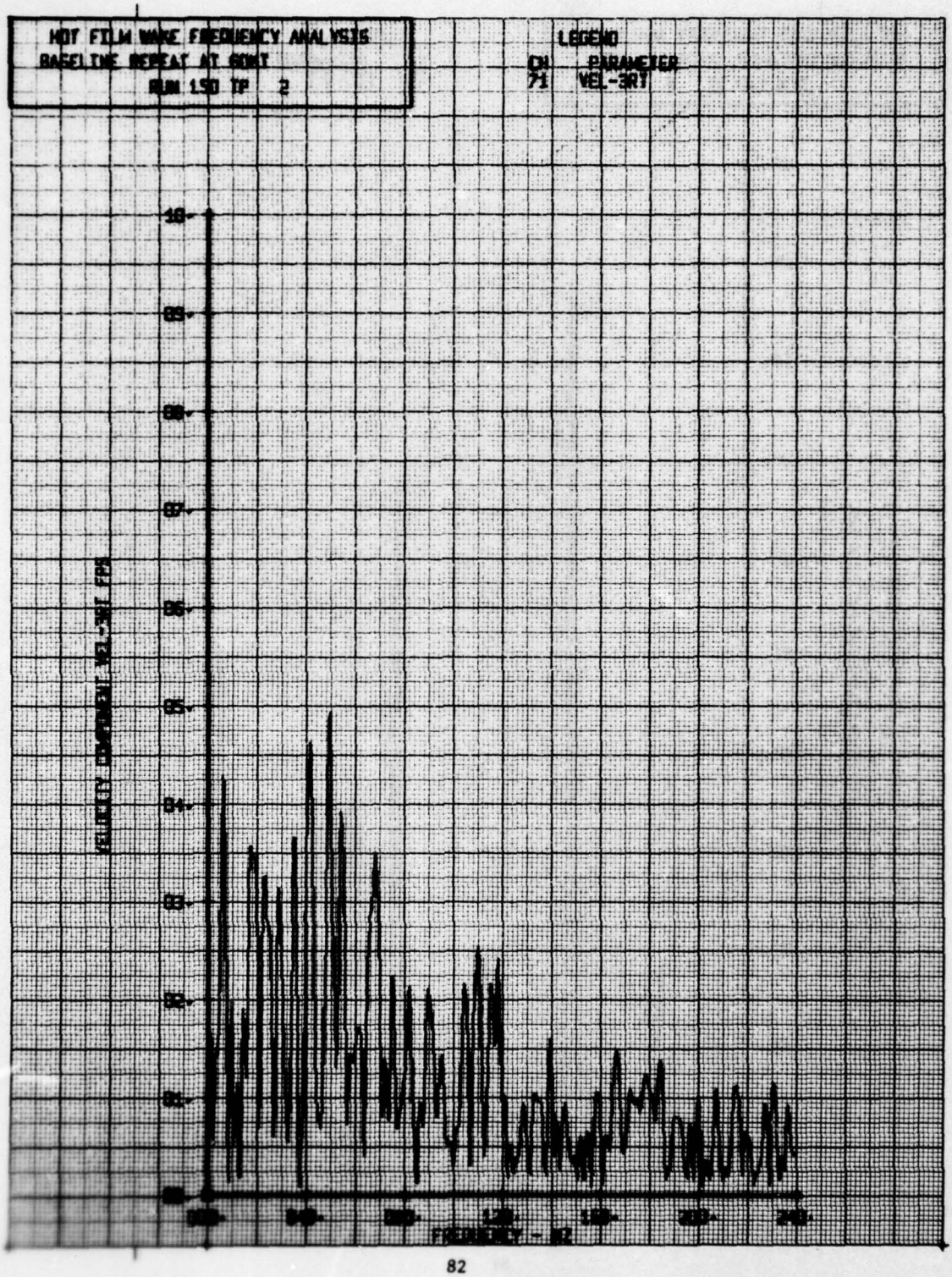

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 5
LEGEND
CH PARAMETER
70 VEL-3LT

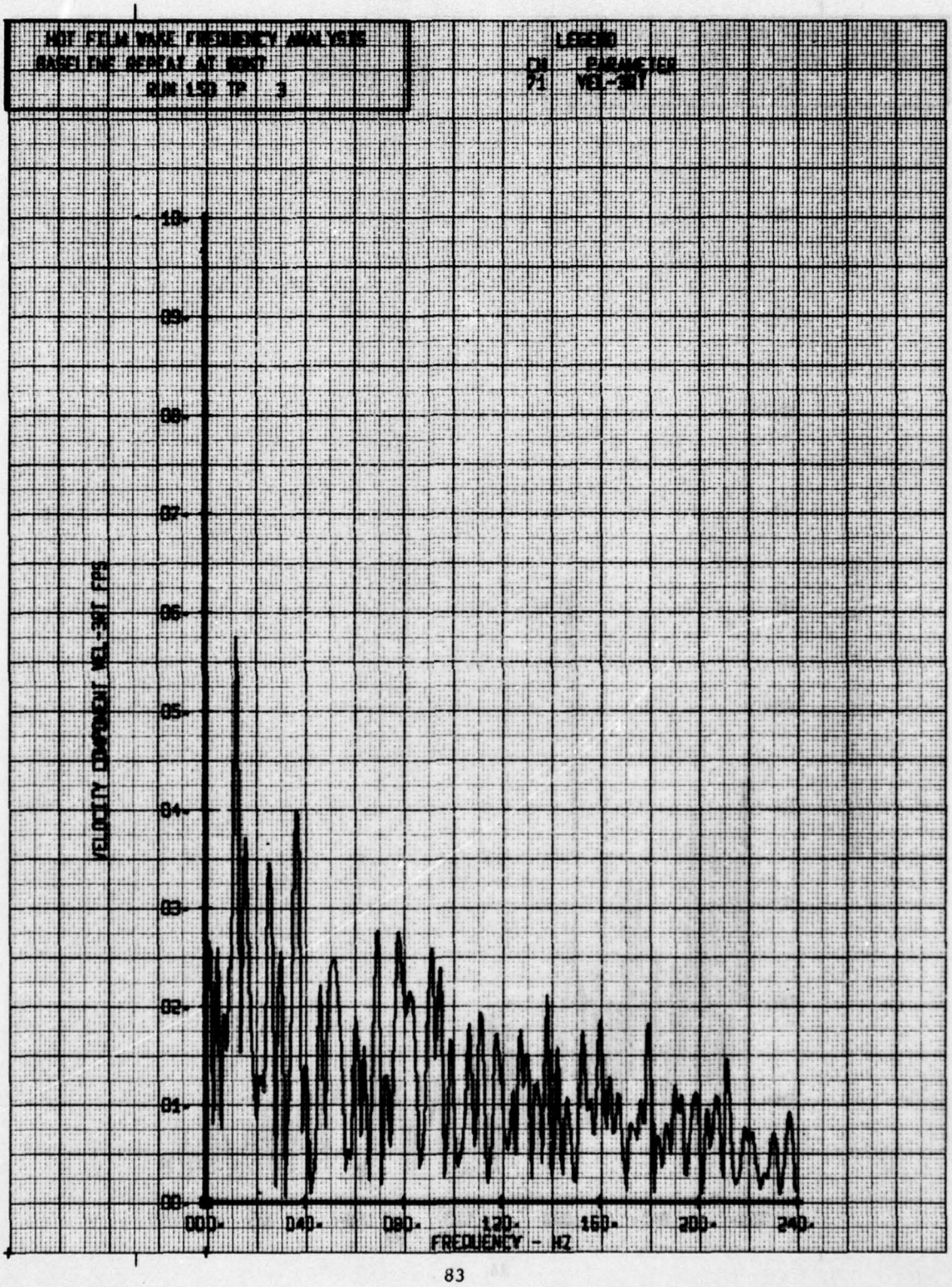

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 149 TP 6
LEGEND
CH PARAMETER
70 VEL-3LT
FREQUENCY - KC


HOT FILM WAKE FREQUENCY ANALYSIS
RUN L40 TP 7
LEGEND
CH PARAMETER
70 VEL-ST
20
09
08
07
06
05
04
03
02
01
00
000
040
080
120
160
200
240
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE AUTO-ID MAGNETS OFF
SUM 140 TP 0
LEGEND
CH PARAMETER
70 VEL-3LT
VELOCITY COMPONENT VEL-3LT FPS
.040
.080
.120
.160
.200
.240
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 9
LEGEND
CH PARAMETER
70 VEL-3LT
10
09
08
07
06
05
04
03
02
01
00
000
040
080
120
160
200
240
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80KT
RUN 150 TP 2
LEGEND
CH PARAMETER
71 VEL-3RT
VELOCITY COMPONENT VEL-3RT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT BOST
RUN 150 TP 3
LEGEND
CH PARAMETER
01 VEL-3BT
VELOCITY COMPONENT VEL-3BT FPS
10
09
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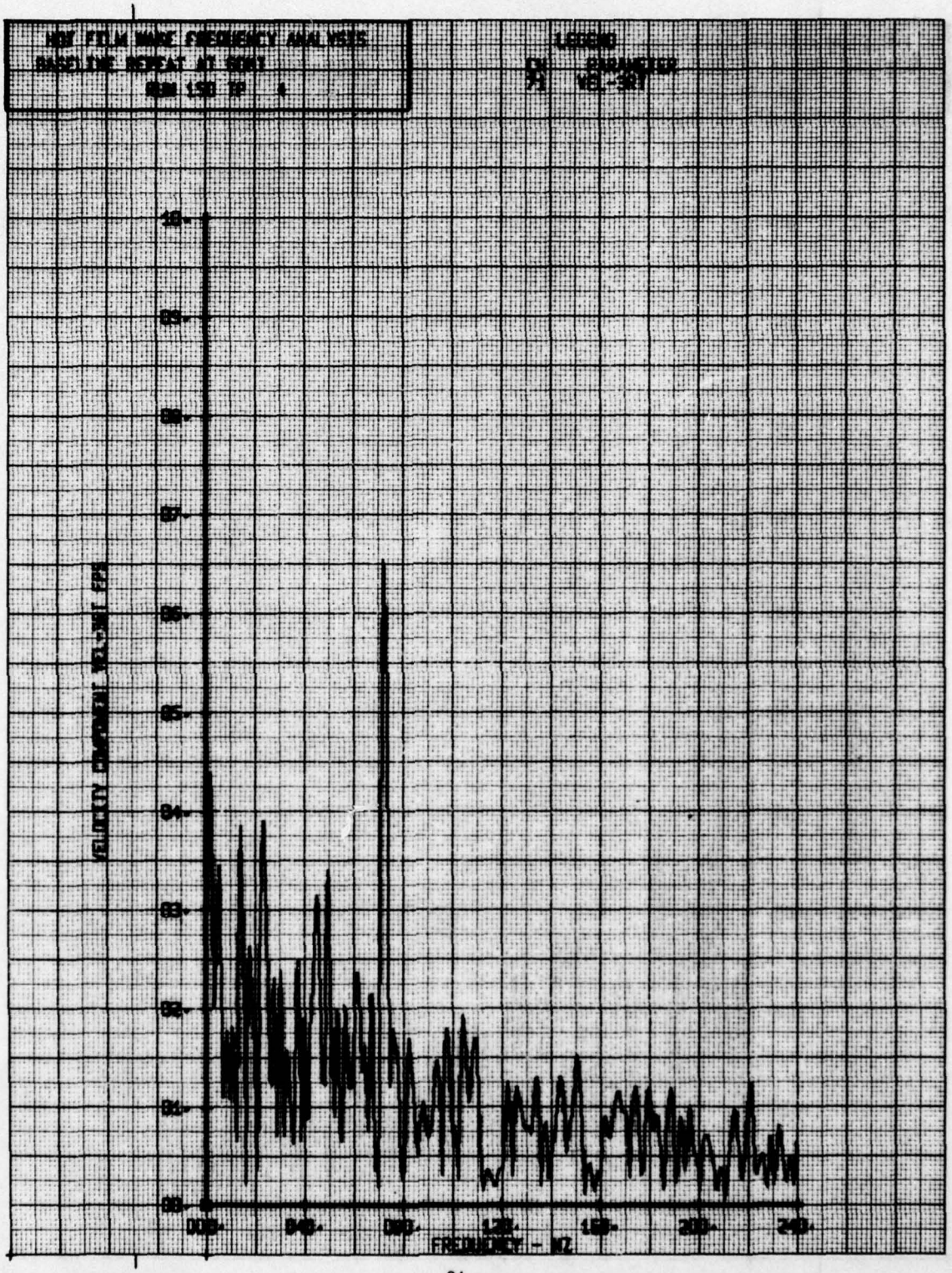
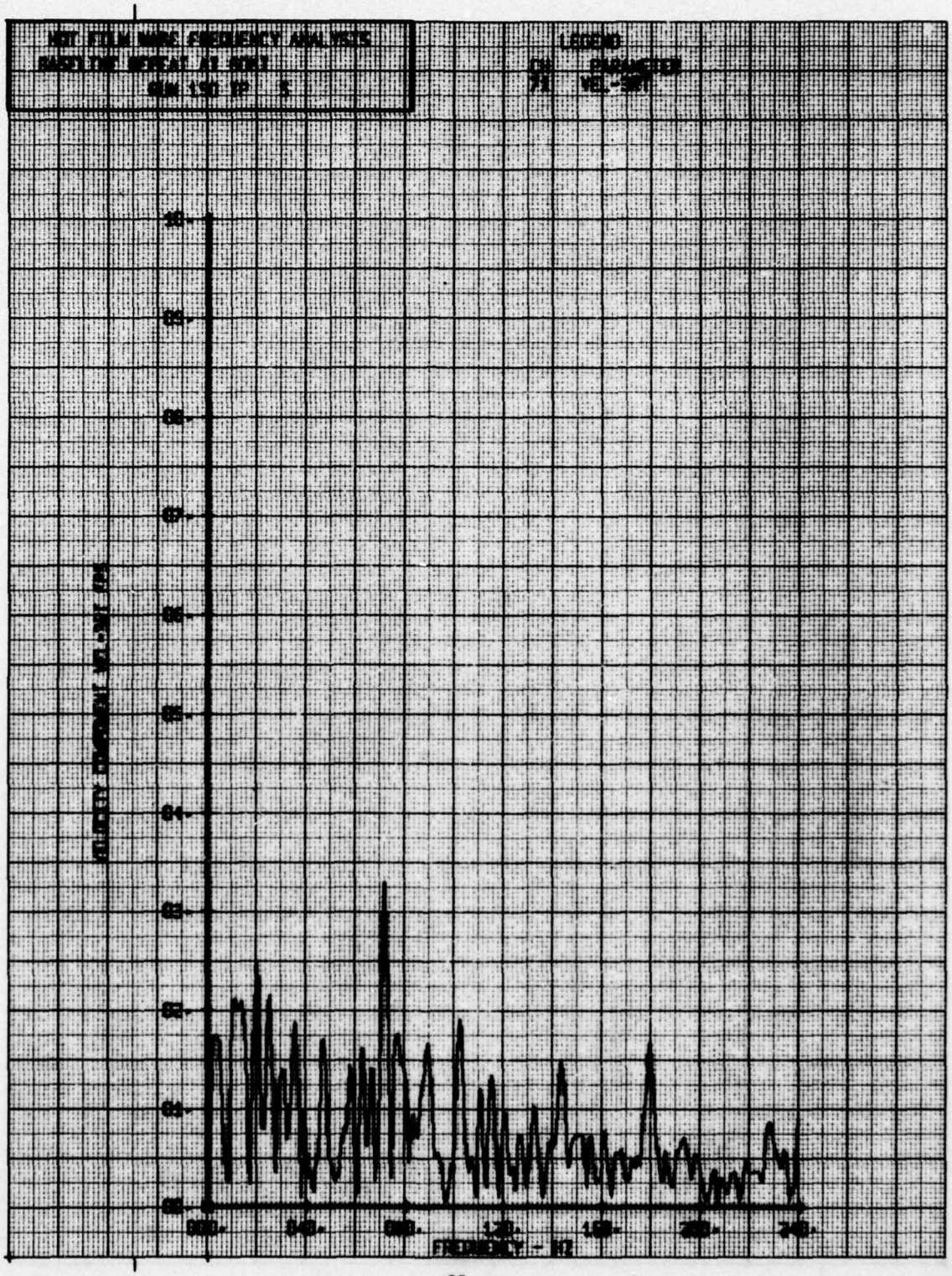
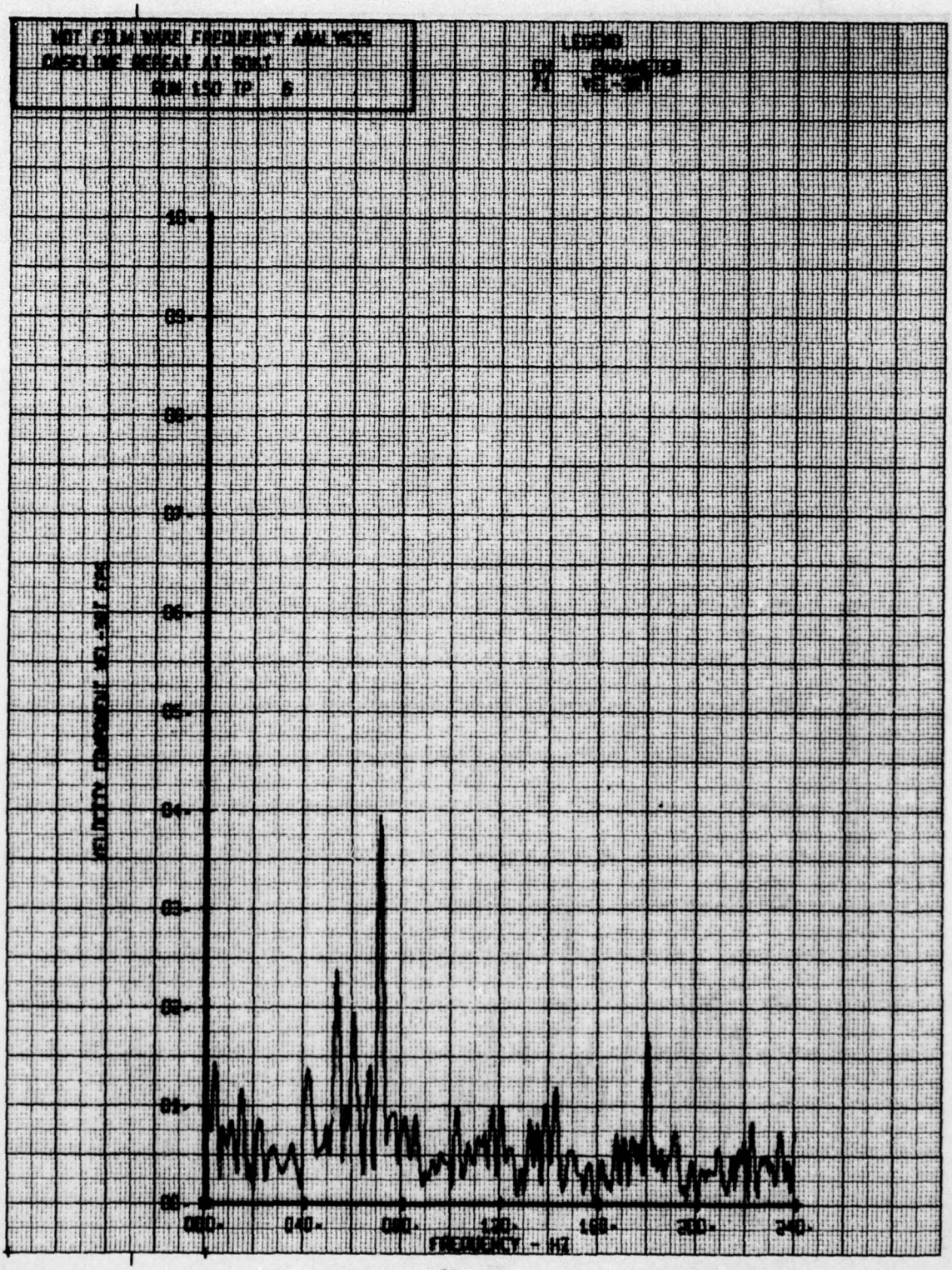
040
080
120
160
200
240
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 0001
LEGEND
CH PARAMETER
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
CH PARAMETER
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 6
LEGEND
CH PARAMETER
P1 VEL-SHT
10-
09-
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000.
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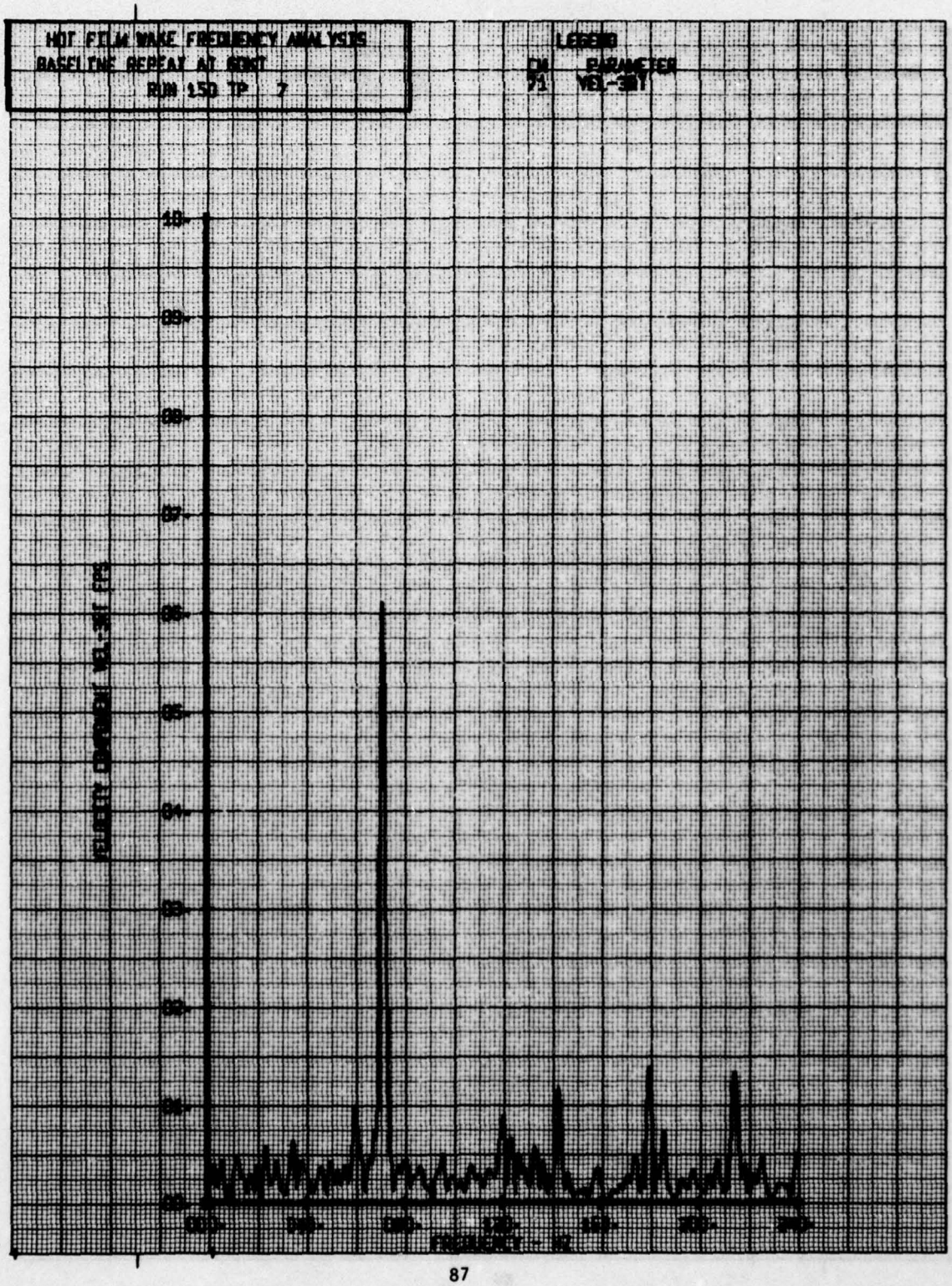
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 7
LEGEND
CH PARAMETER
P1 VEL-3BT
1.0
.9
.8
.7
.6
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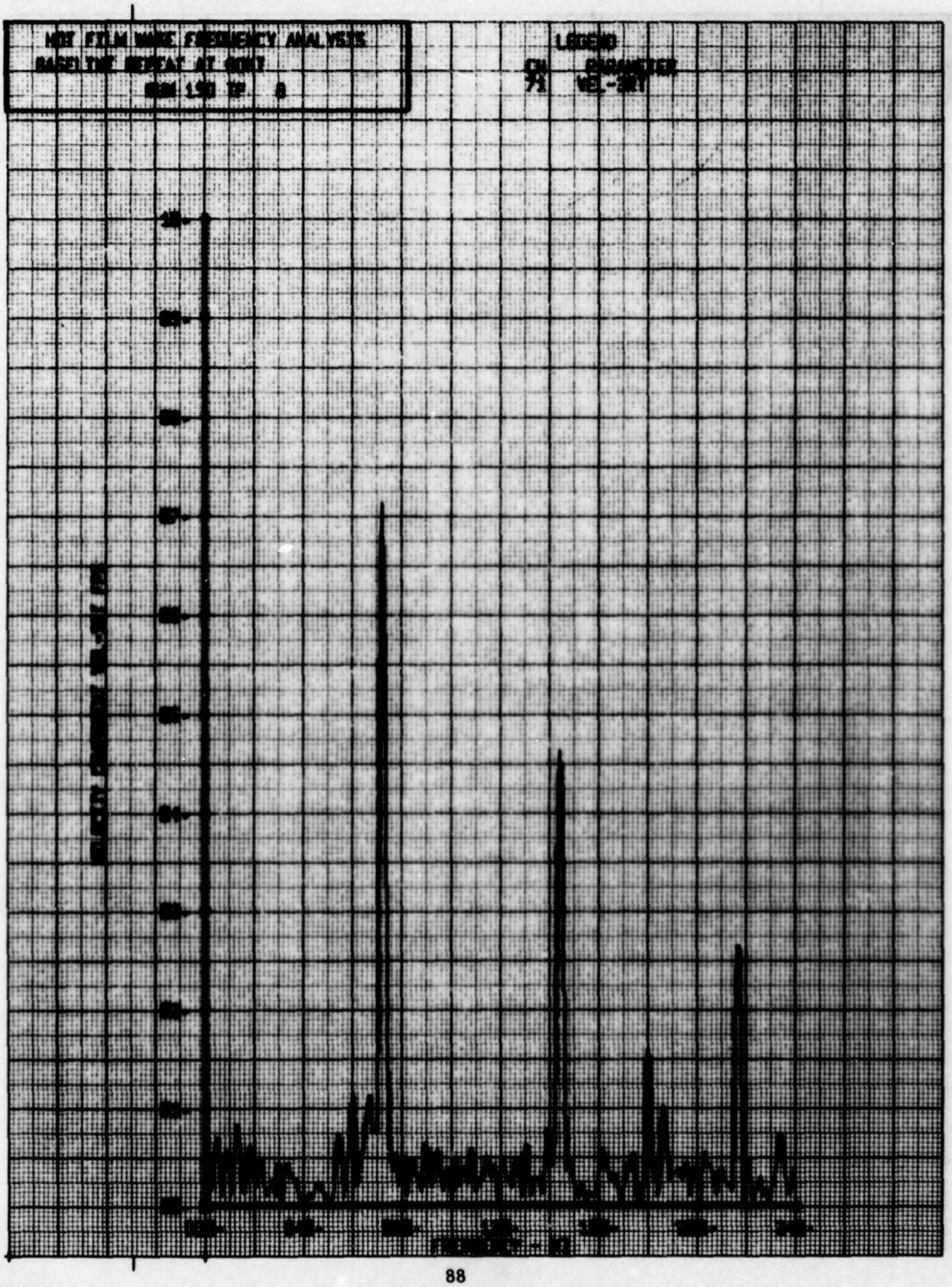
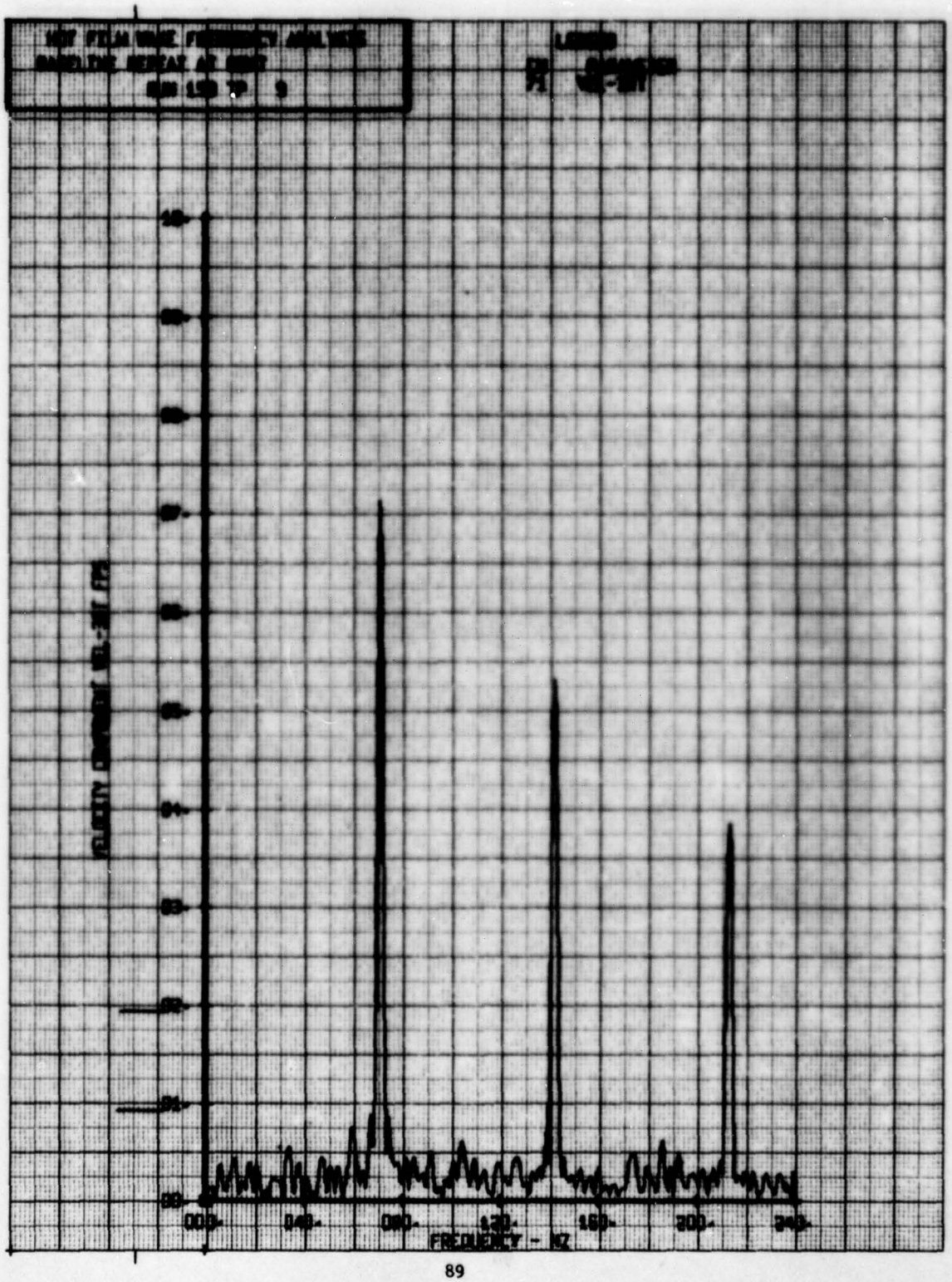
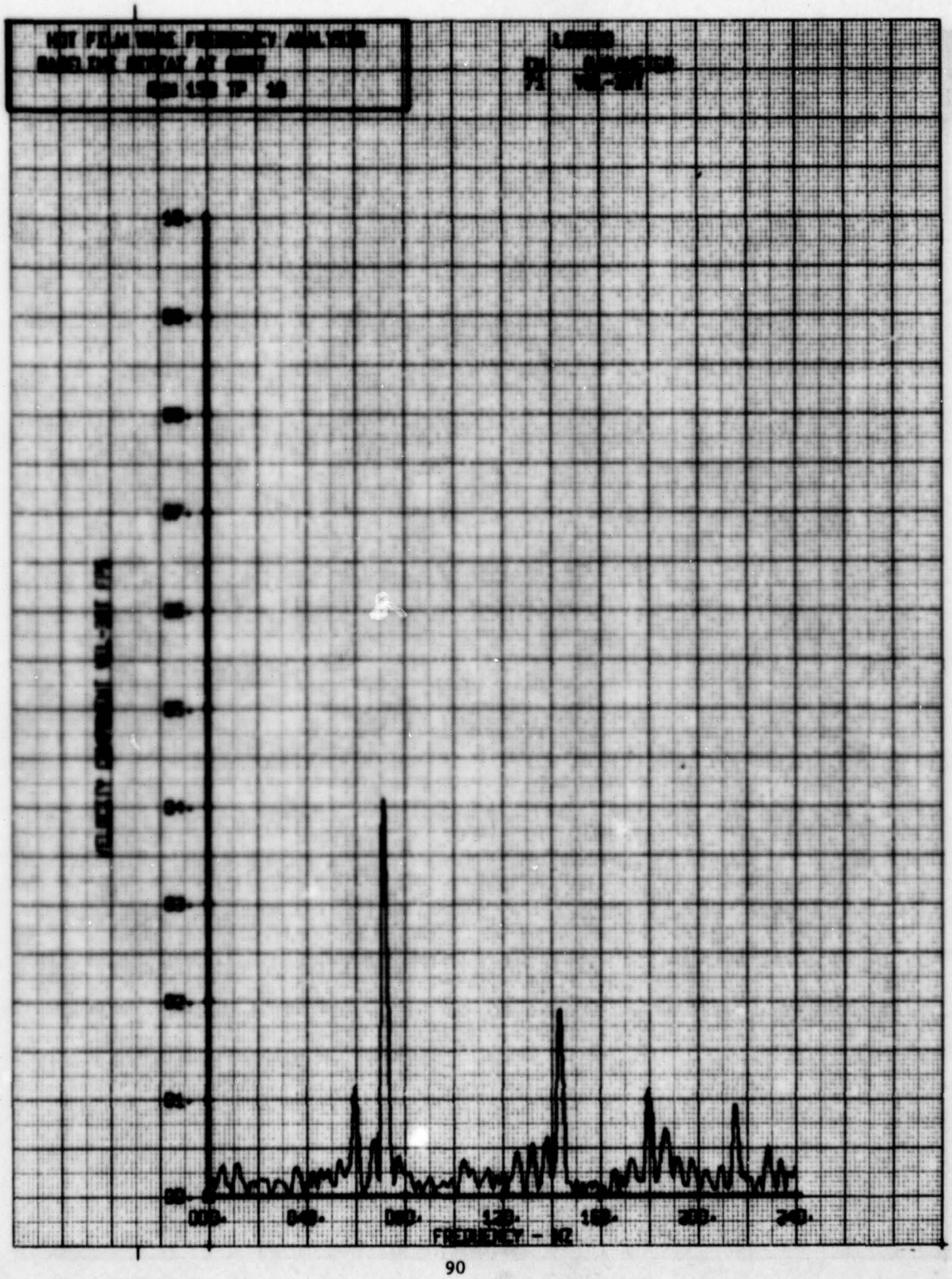
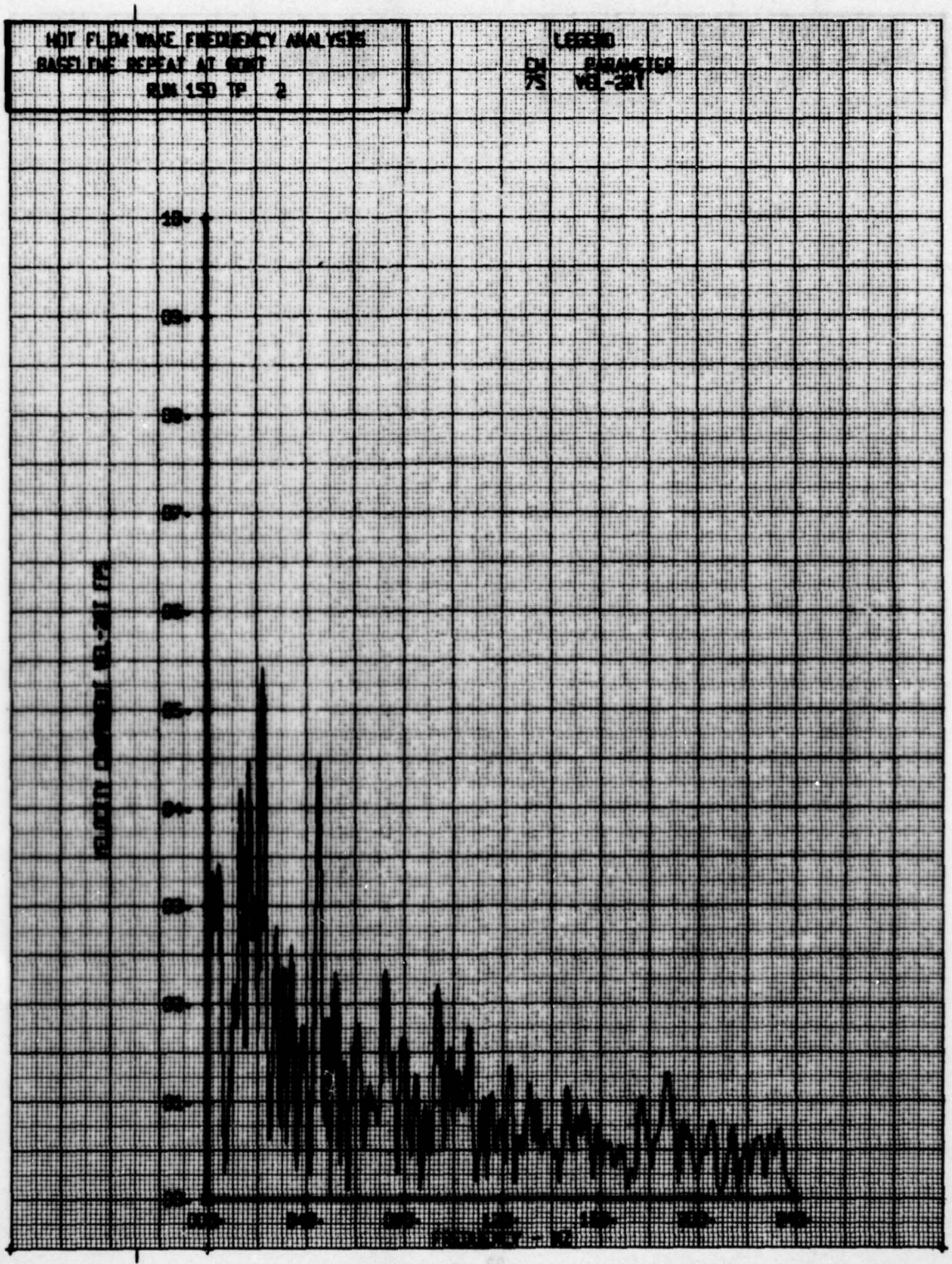
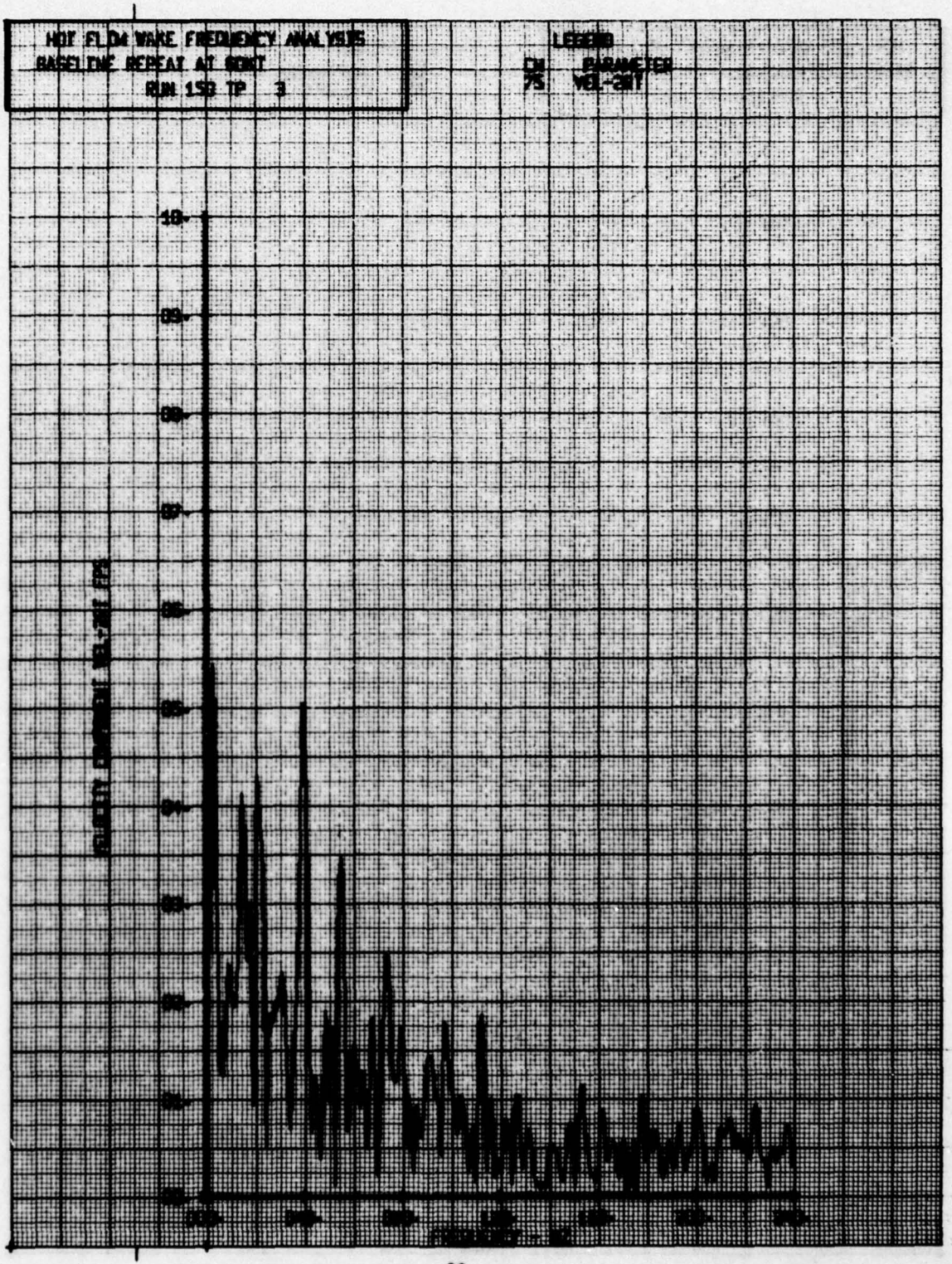
.4
.3
.2
.1
0.0
MEAN SQUARED AMPLITUDE (VOLTS-RMS)**2
0.0
1.0
2.0
3.0
4.0
5.0
6.0
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 0000
RUN 150 TP 8
LEGEND
CH PARAMETER
71 VEL-SPY


FREQUENCY - HZ


FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80KT
RUN 150 TP 2
LEGEND
CH PARAMETER
75 VEL-2BY


HOT FLOW WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 90KT
RUN 153 TP 3
LEGEND
CH PARAMETER
75 VOL-DIT
10
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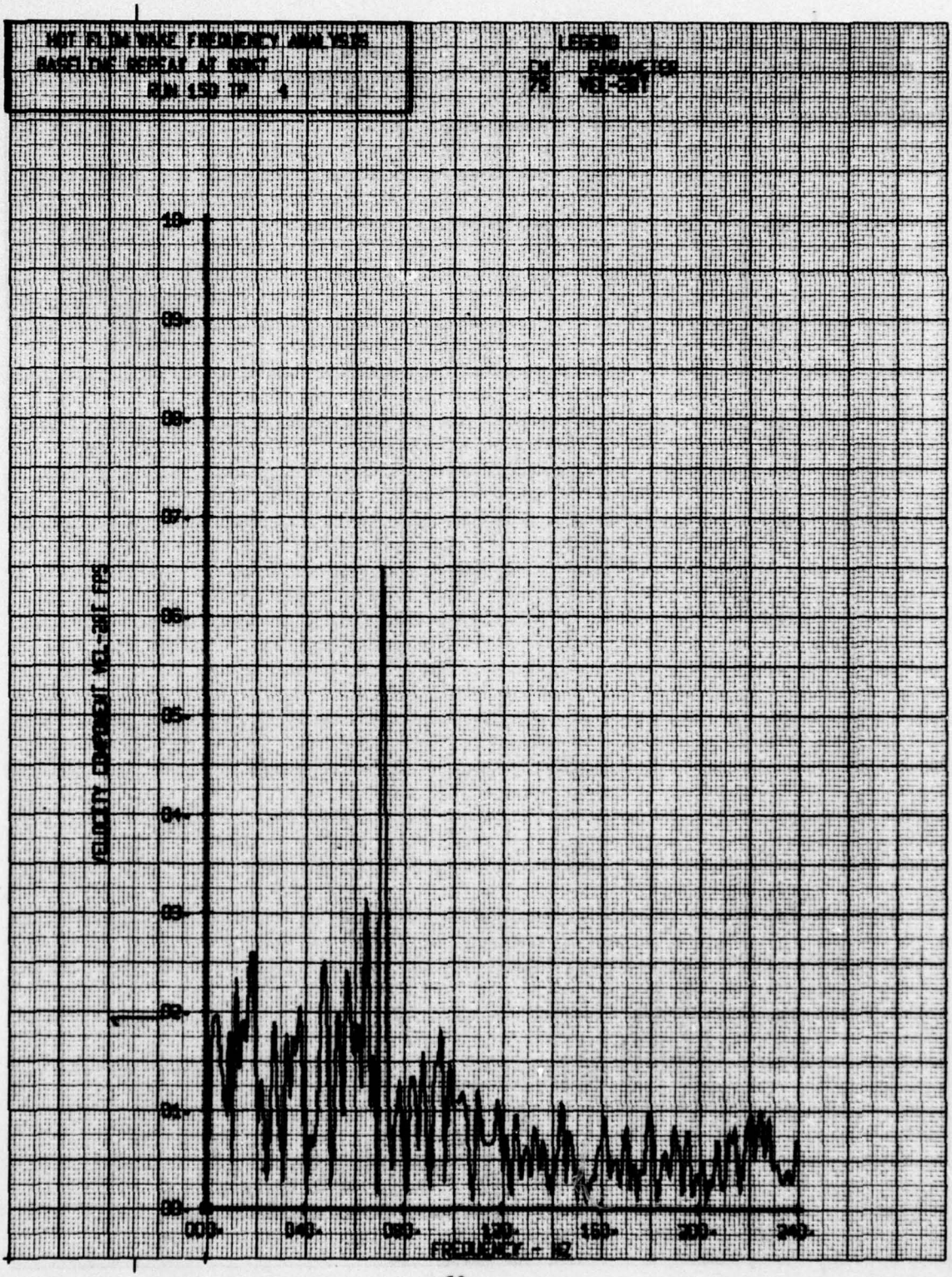
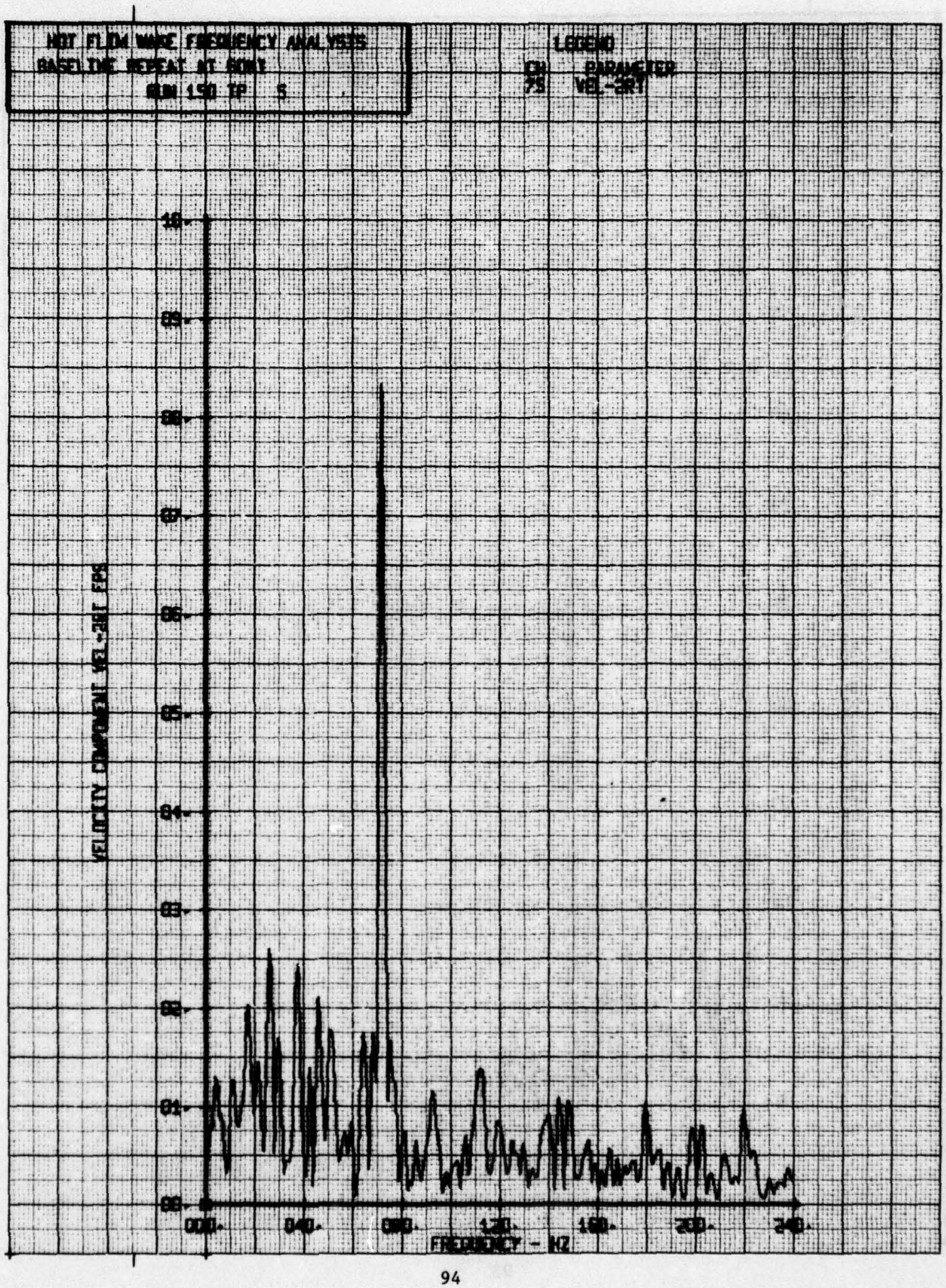
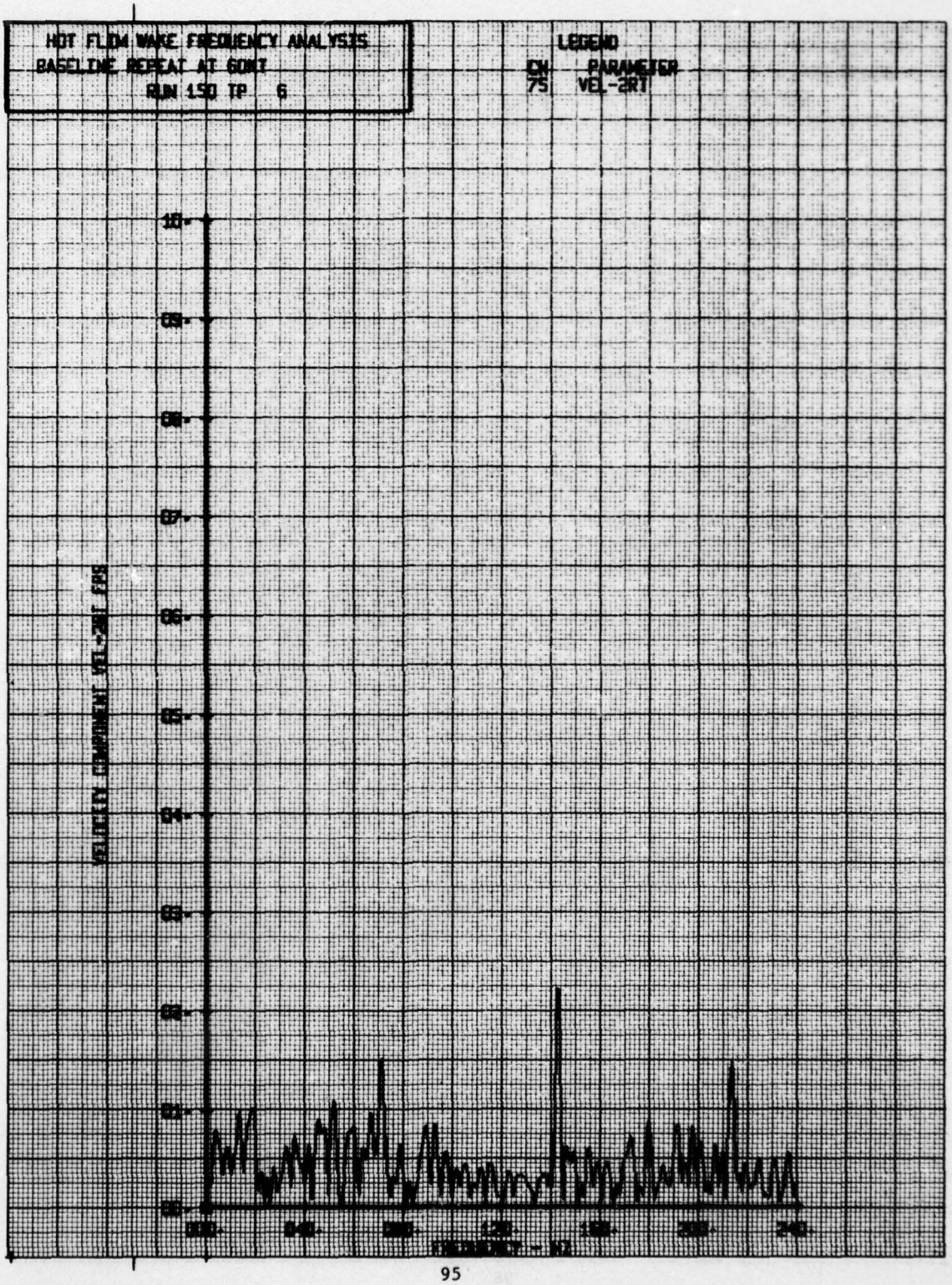

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80KT
RUN 150 TP 4
LEGEND
DIA PARAMETER
75 VEL-2DT
VELOCITY COMPONENT VEL-2DT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT ROW1
RUN 150 TP 5
LEGEND
CH PARAMETER
75 VEL-3RT
VELOCITY COMPONENT VEL-3RT FPS
FREQUENCY - HZ


HOT FLOW WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 6
LEGEND
CH PARAMETER
75 VEL-2RT
VELOCITY COMPONENT VEL-2RT FPS
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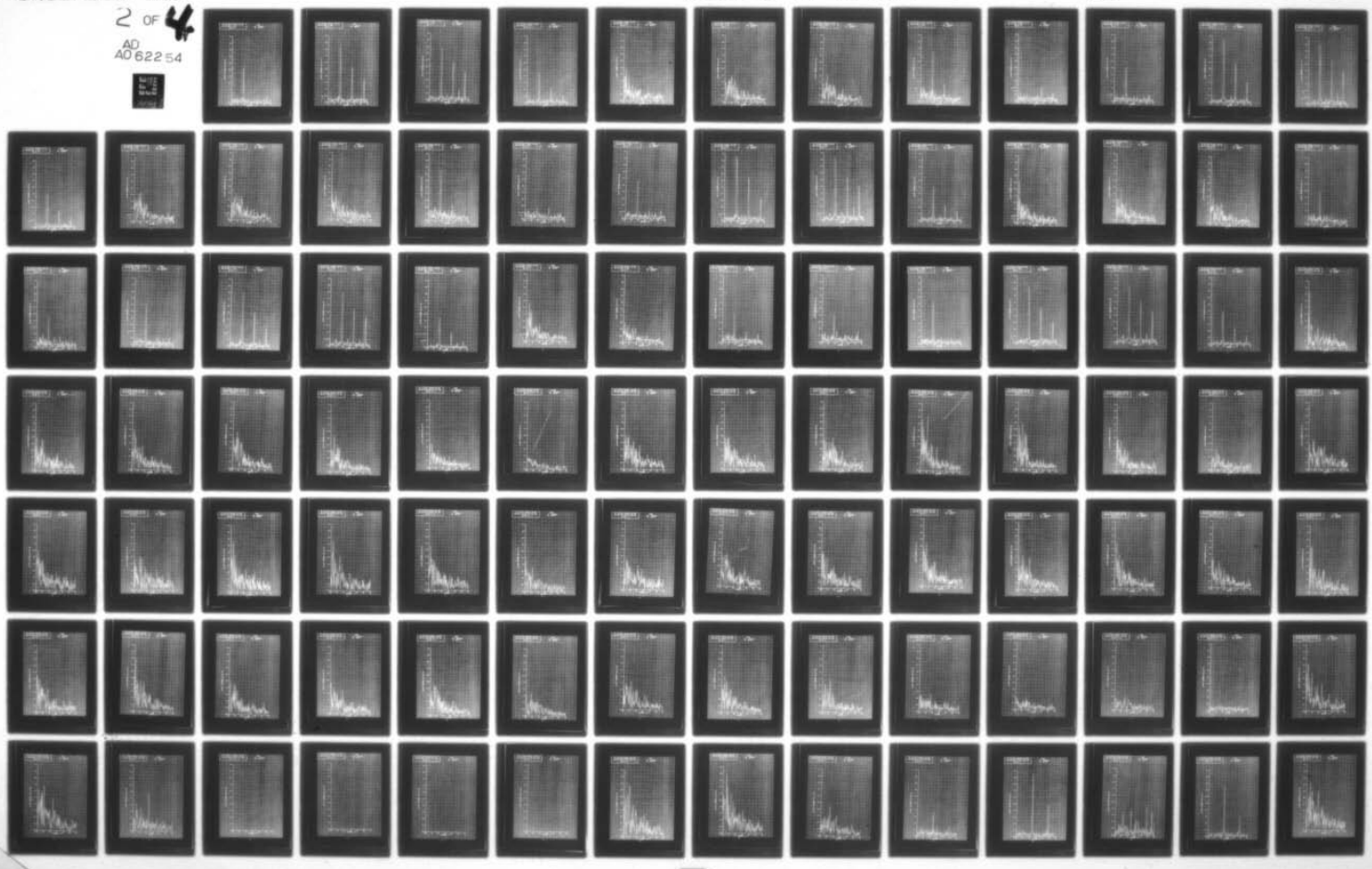
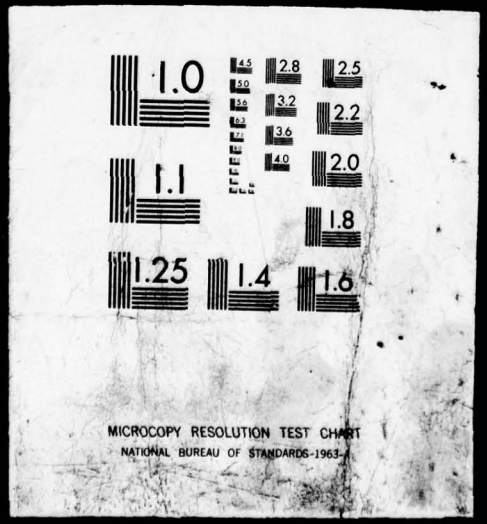
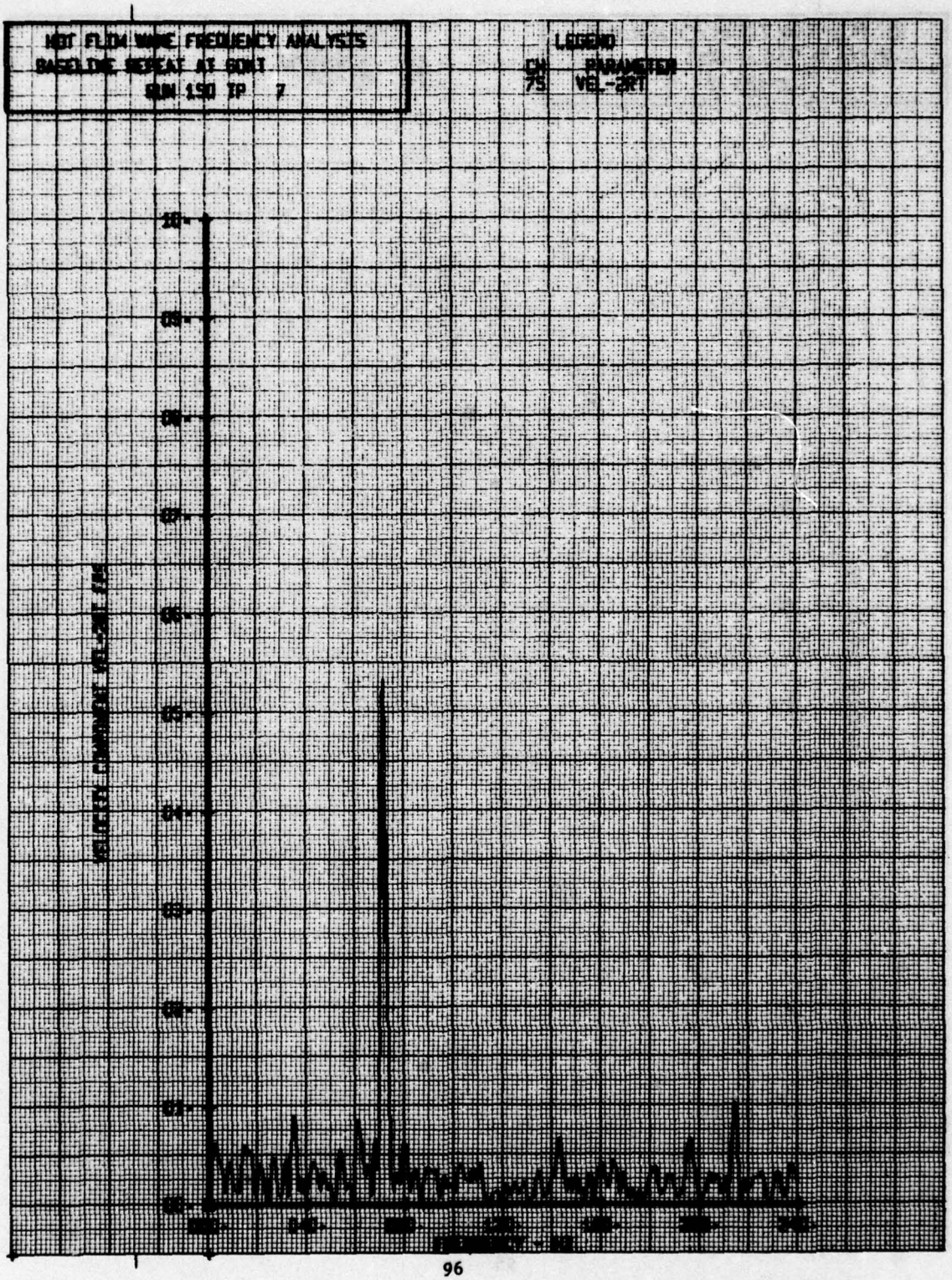
AD-A062 254 BOEING VERTOL CO PHILADELPHIA PA F/G 1/3
INTERACTIONAL AERODYNAMIC OF THE SINGLE ROTOR HELICOPTER CONFIG--ETC(U)
SEP 78 P F SHERIDAN DAAJ02-77-C-0020
UNCLASSIFIED USARTL-TR-78-23H NL

2 OF 4
AD
AD622254






HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80KT
RUN 150 TP 7
LEGEND
CH PARAMETER
75 VEL-2RT
1.0
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.8
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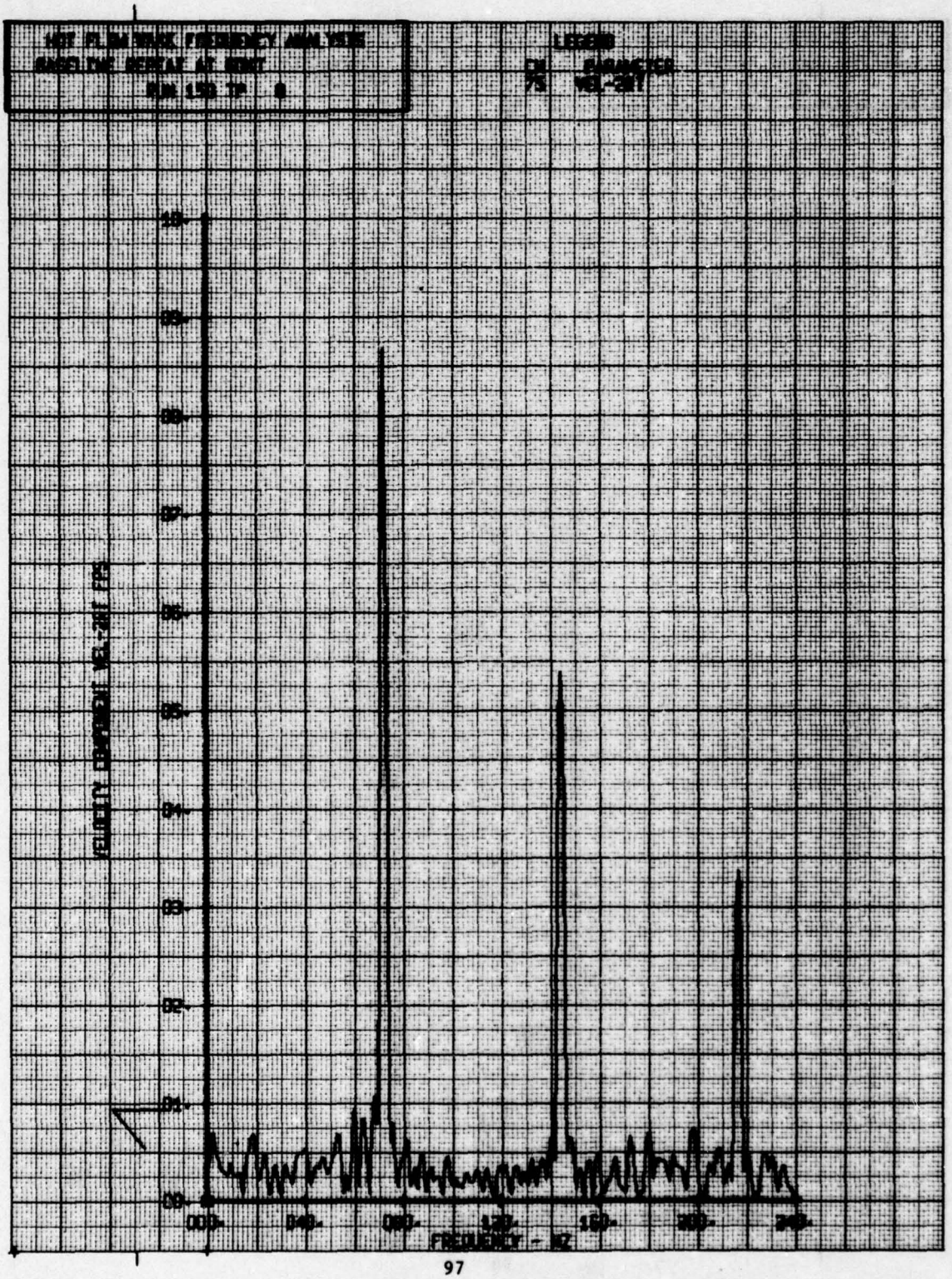
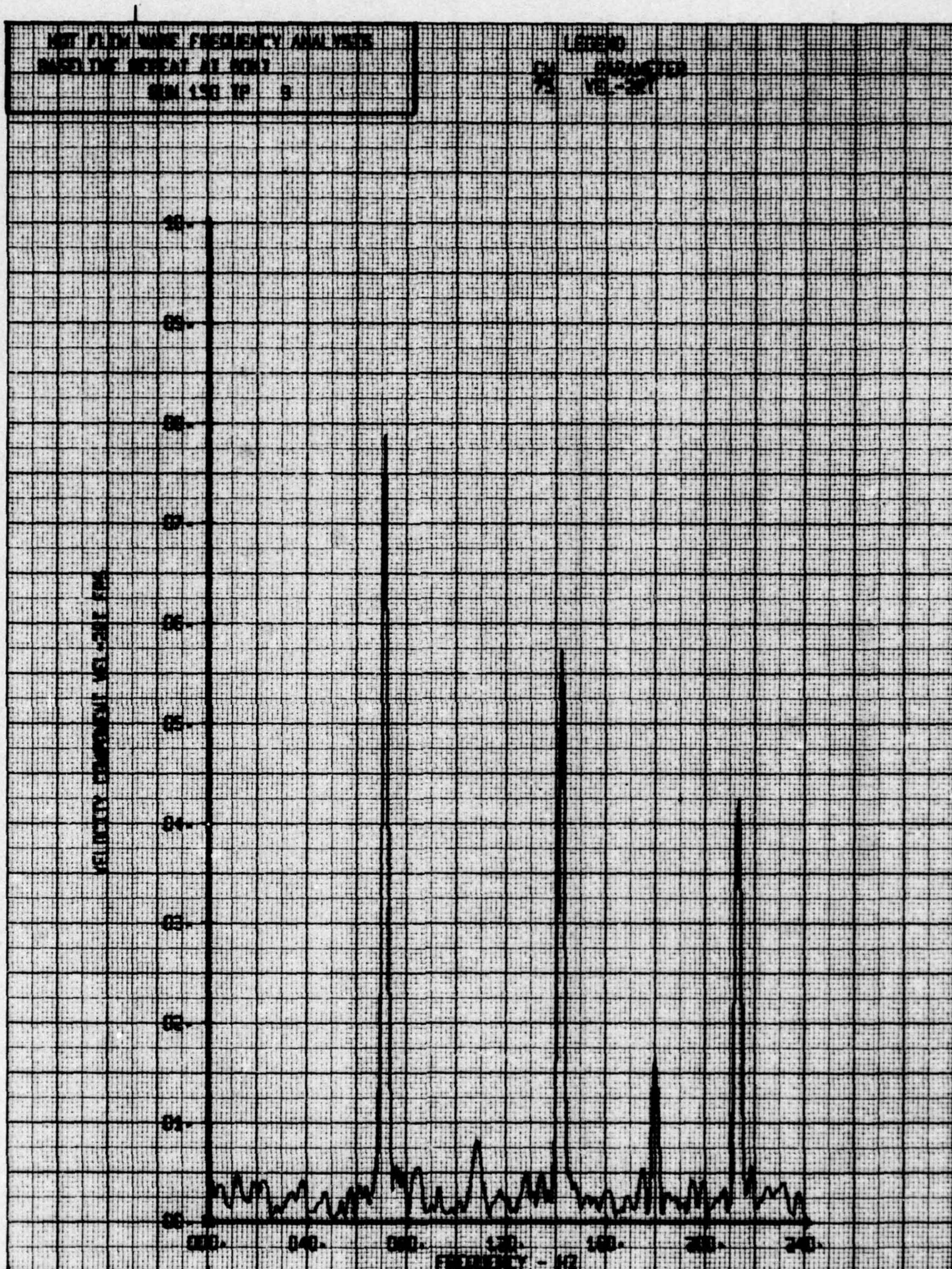
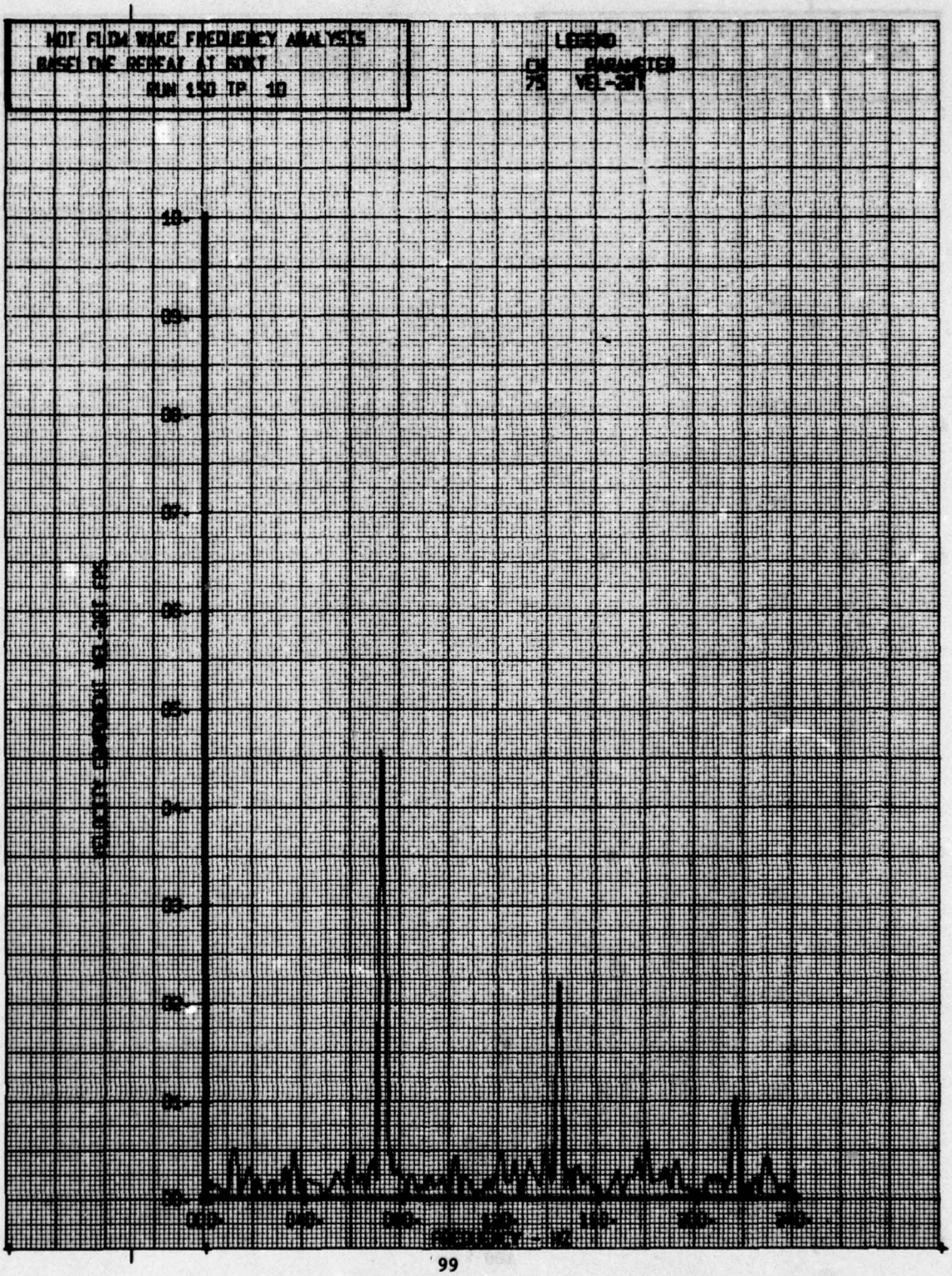
0
VELOCITY CHANGE (FT/SEC) AMP


HOT FLOW RACK FREQUENCY ANALYSIS
RUN 150 TP 8
LEGEND
75
FREQUENCY - HZ


FREQUENCY ANALYSIS
LEGEND
PARAMETER
000
040
080
120
160
200
240
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80KT
RUN 150 TP 10
LEGEND
CH PARAMETER
75 VEL-SBT
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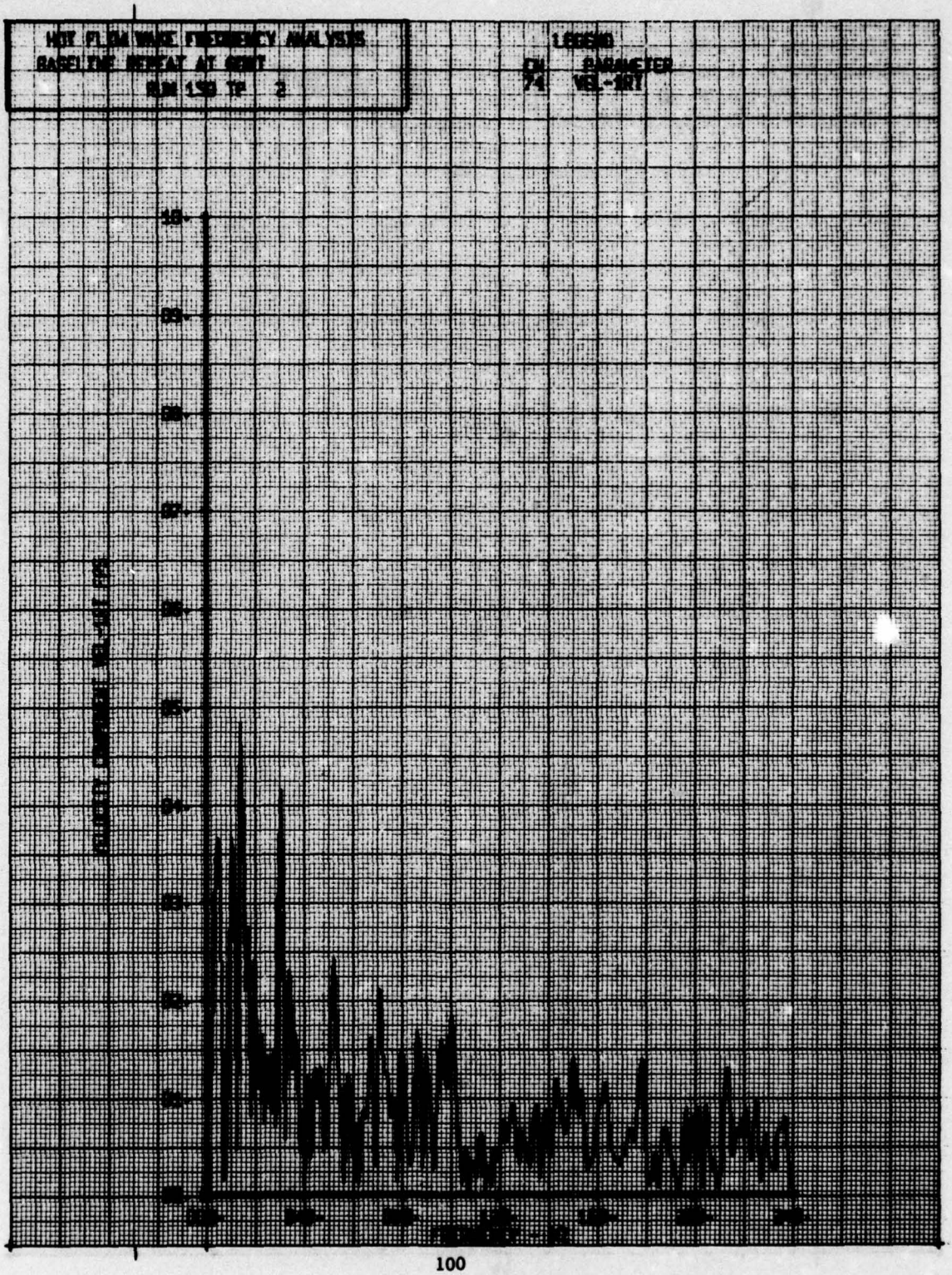
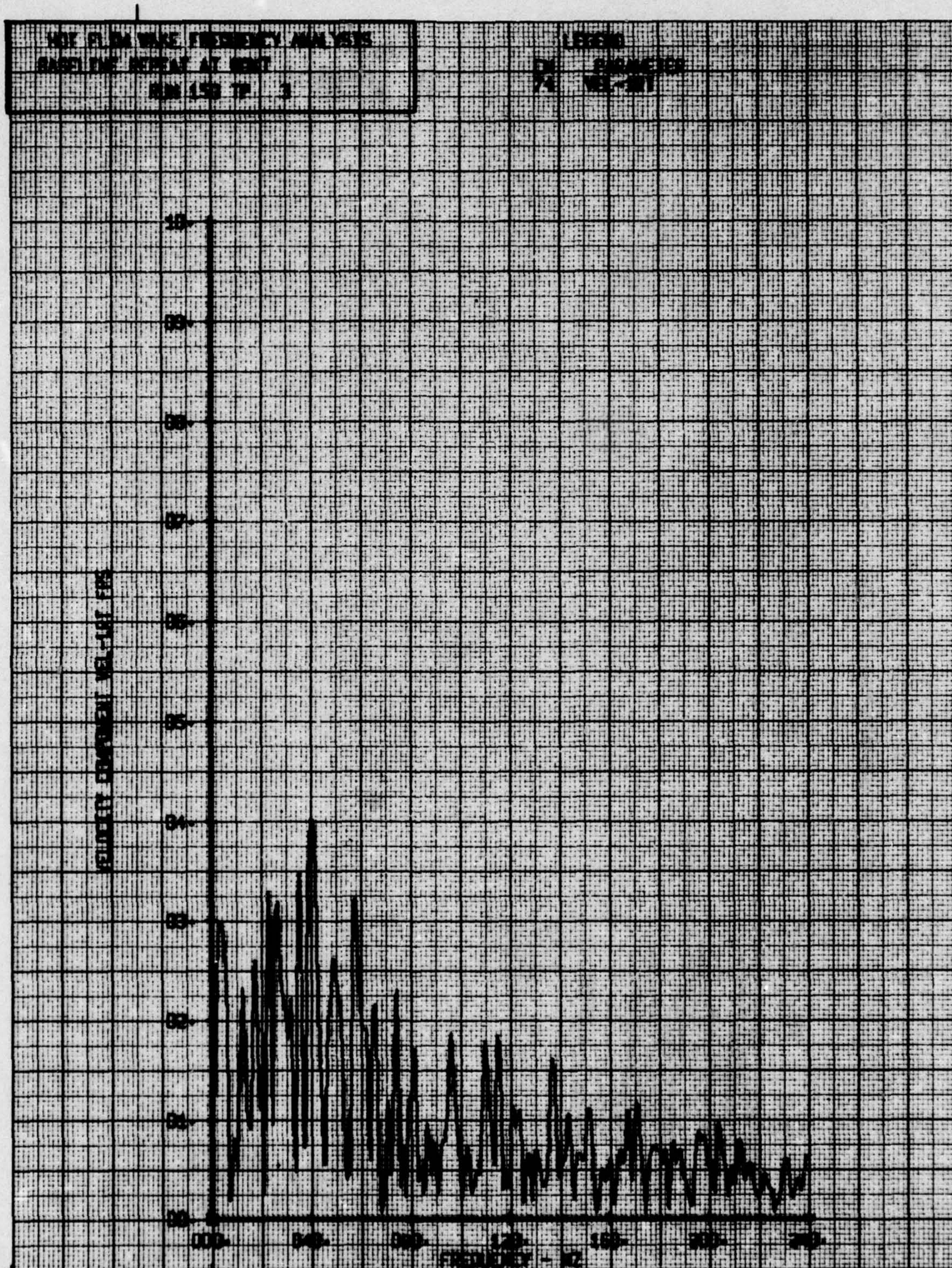
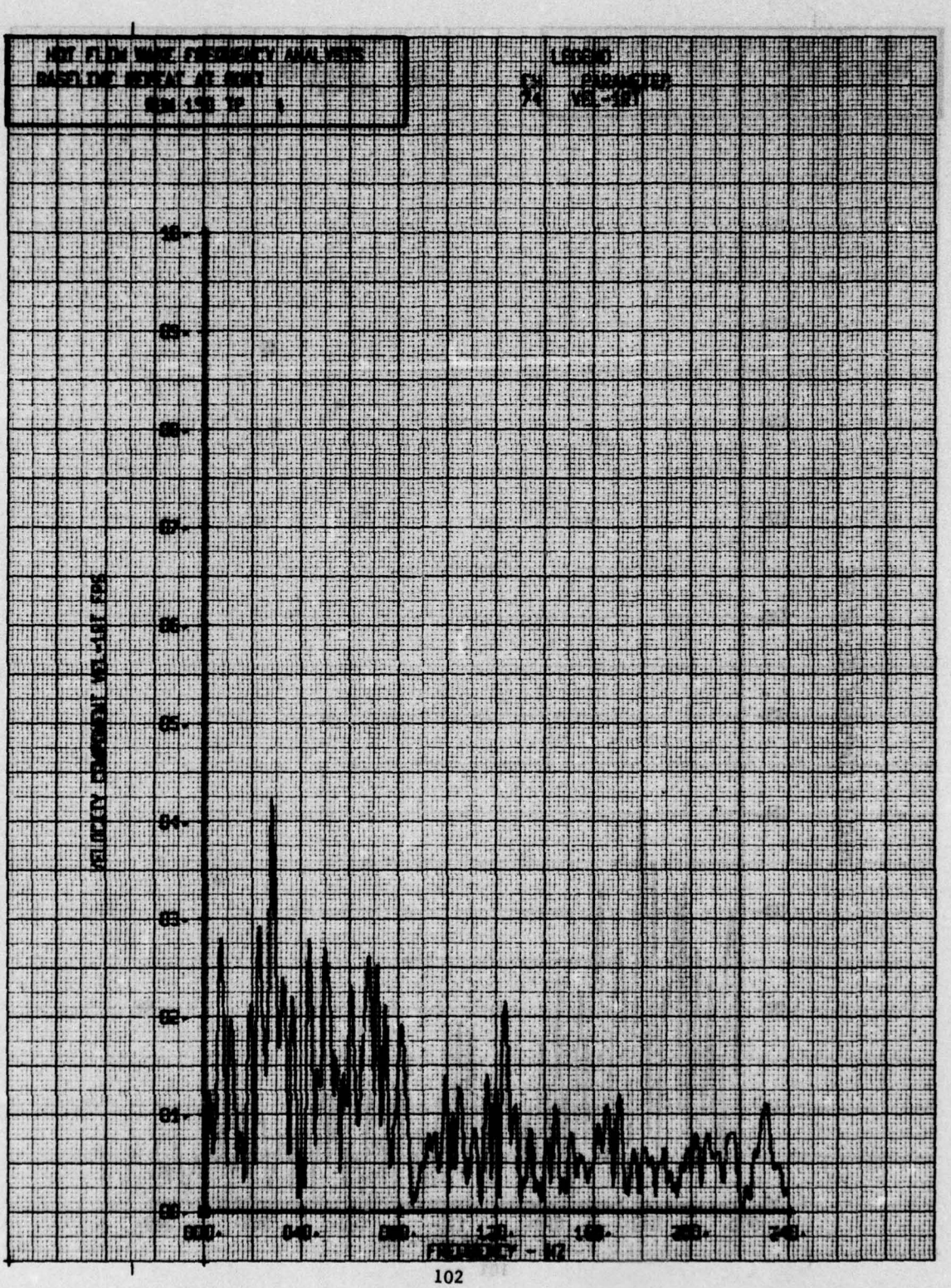
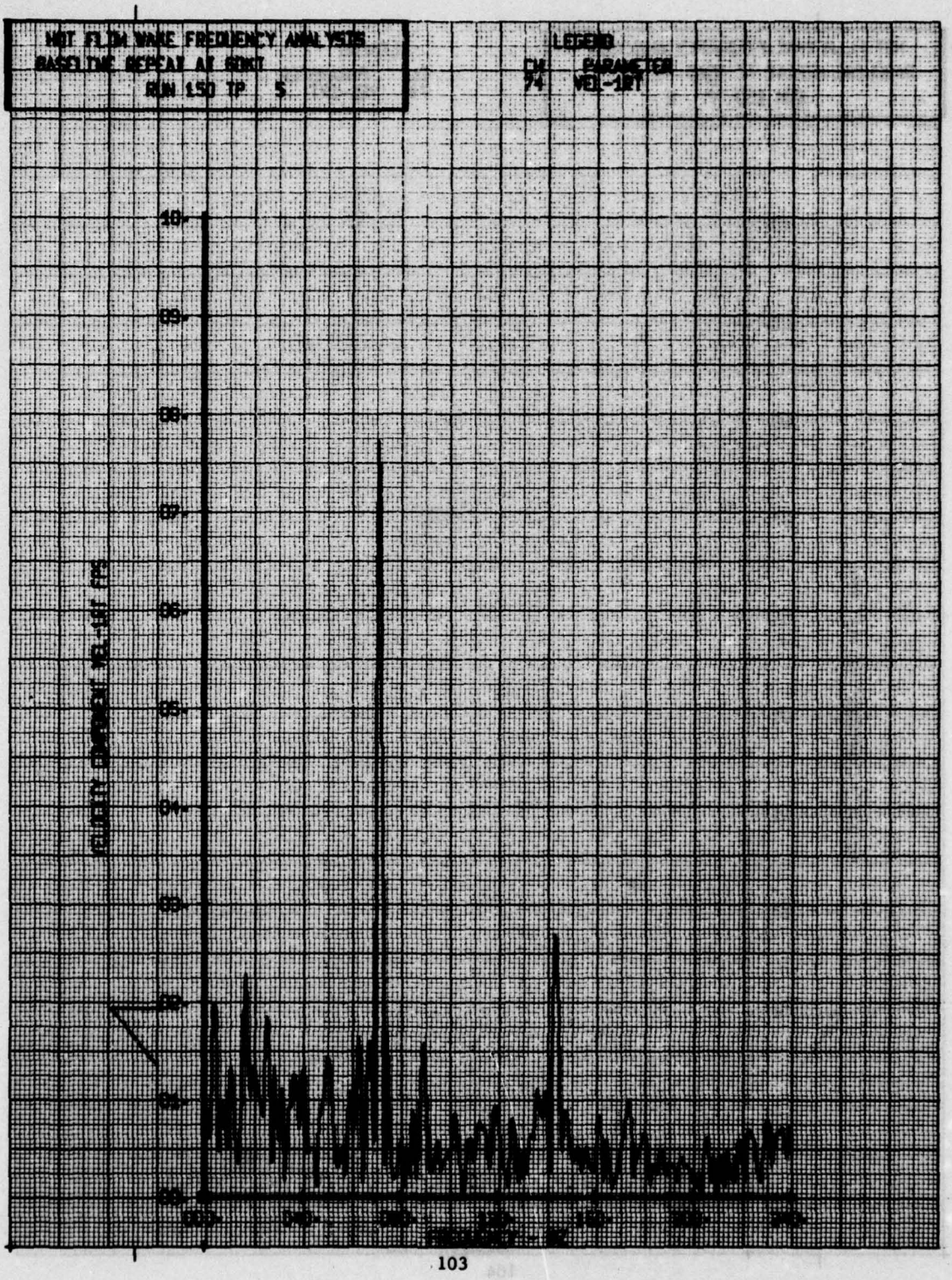
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 600T
RUN 150 TP 2
LEGEND
CH PARAMETER
74 VEL-SRT
FOURIER COMPONENT VELOCITY RMS


HOT FLOW WAKE FREQUENCY ANALYSIS
LEGEND
PARAMETER
FREQUENCY


LEGEND
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80KT
RUN 150 TP 5
LEGEND
CH CHARACTER
74 VEL-1PT
10
09
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04
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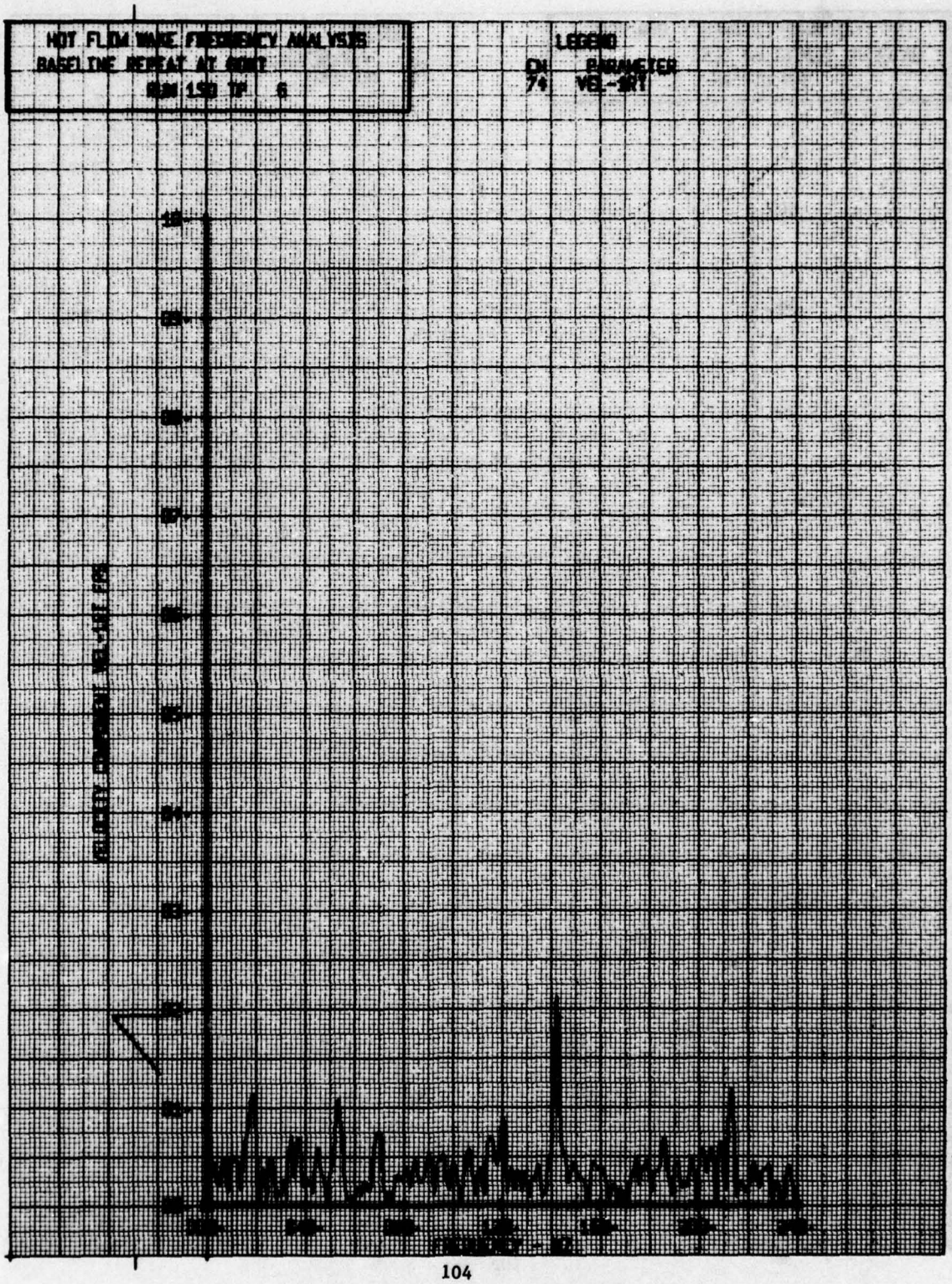
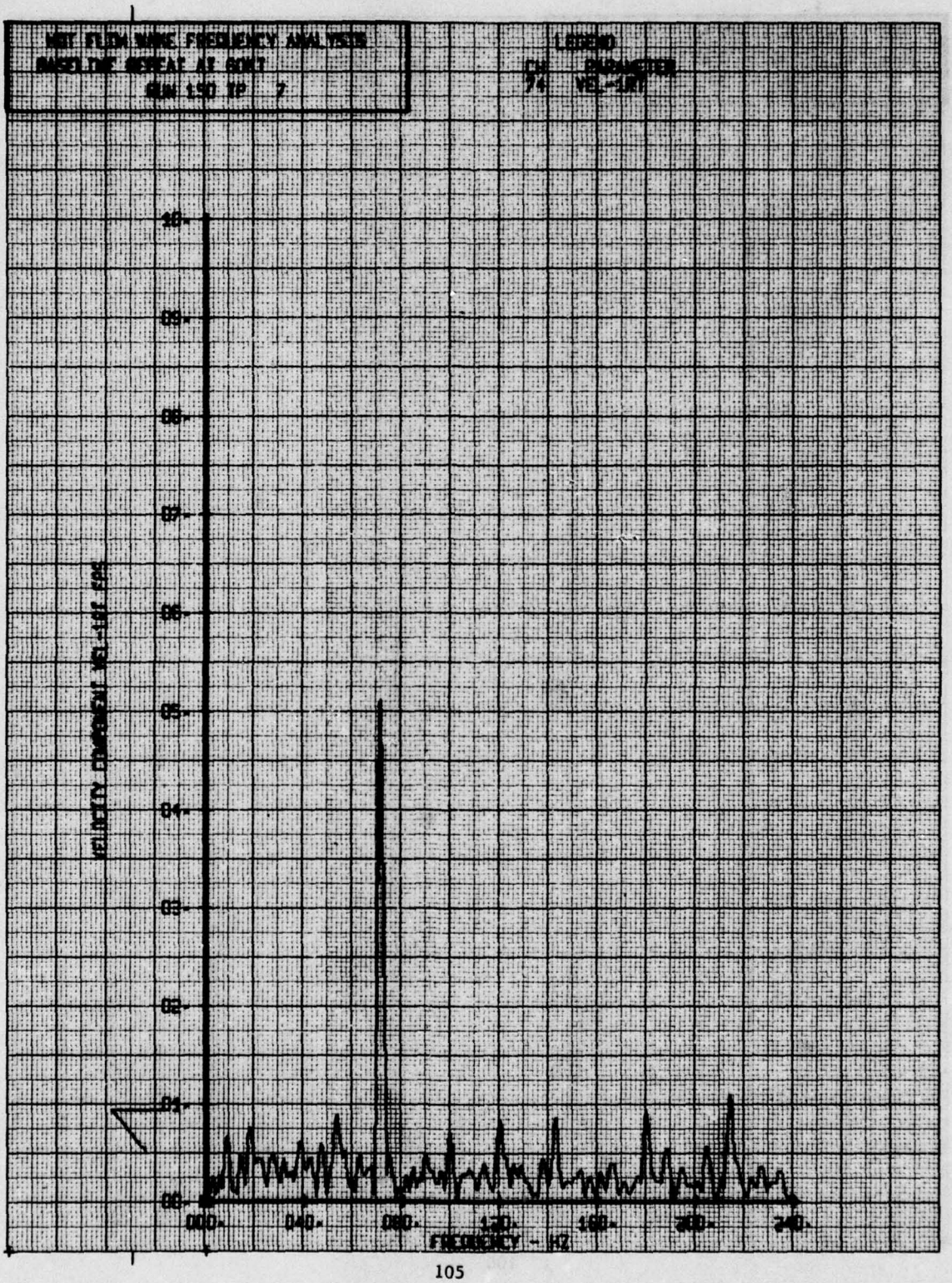
00
FREQUENCY (CHANNEL VEL-1PT) cps


HOT FLOW WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80KT
RUN 150 TP 6
LEGEND
CH PARAMETER
74 VEL-BRT


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 7
LEGEND
CH PARAMETER
74 VEL-1RT
10-
09-
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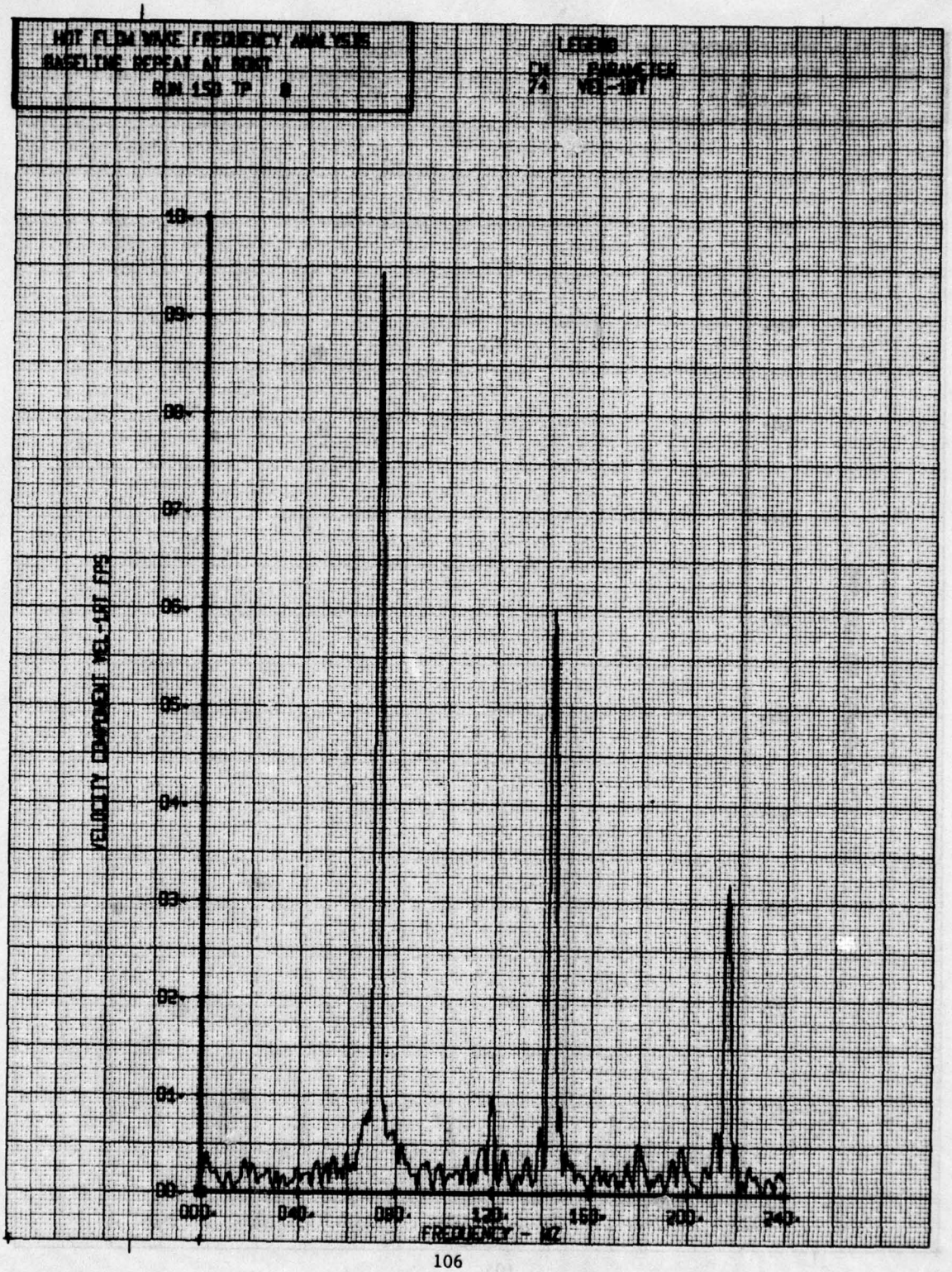
240-
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT NDRT
RUN 150 TP 8
LEGEND
CH PARAMETER
74 VEL-UBT
VELOCITY COMPONENT VEL-UBT FPS
10.
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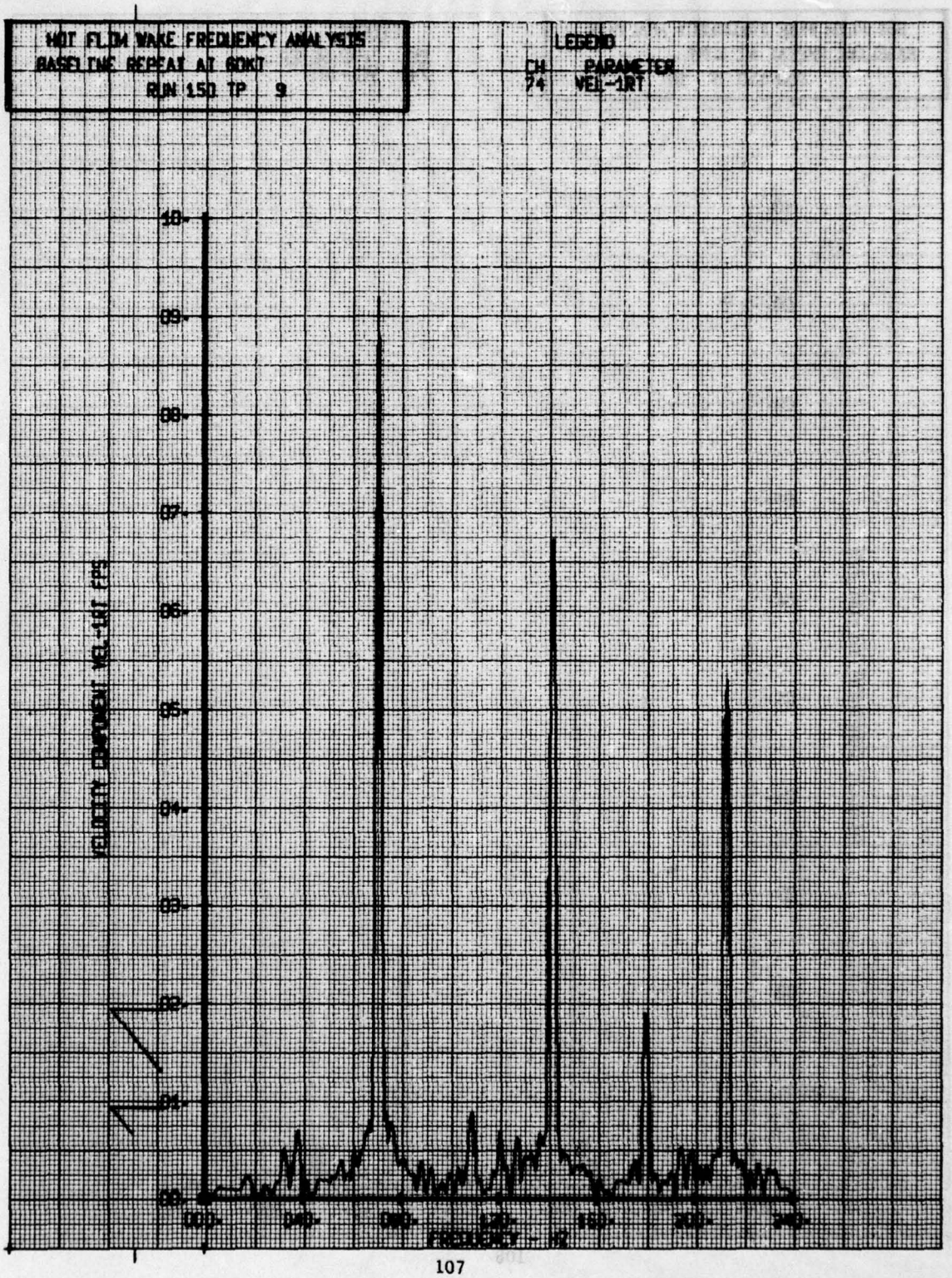
200.
240.
FREQUENCY - HZ


HOT FLOW WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 9
LEGEND
CH PARAMETER
74 VEL-1RT
VELOCITY COMPONENT VEL-1RT FPS
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160
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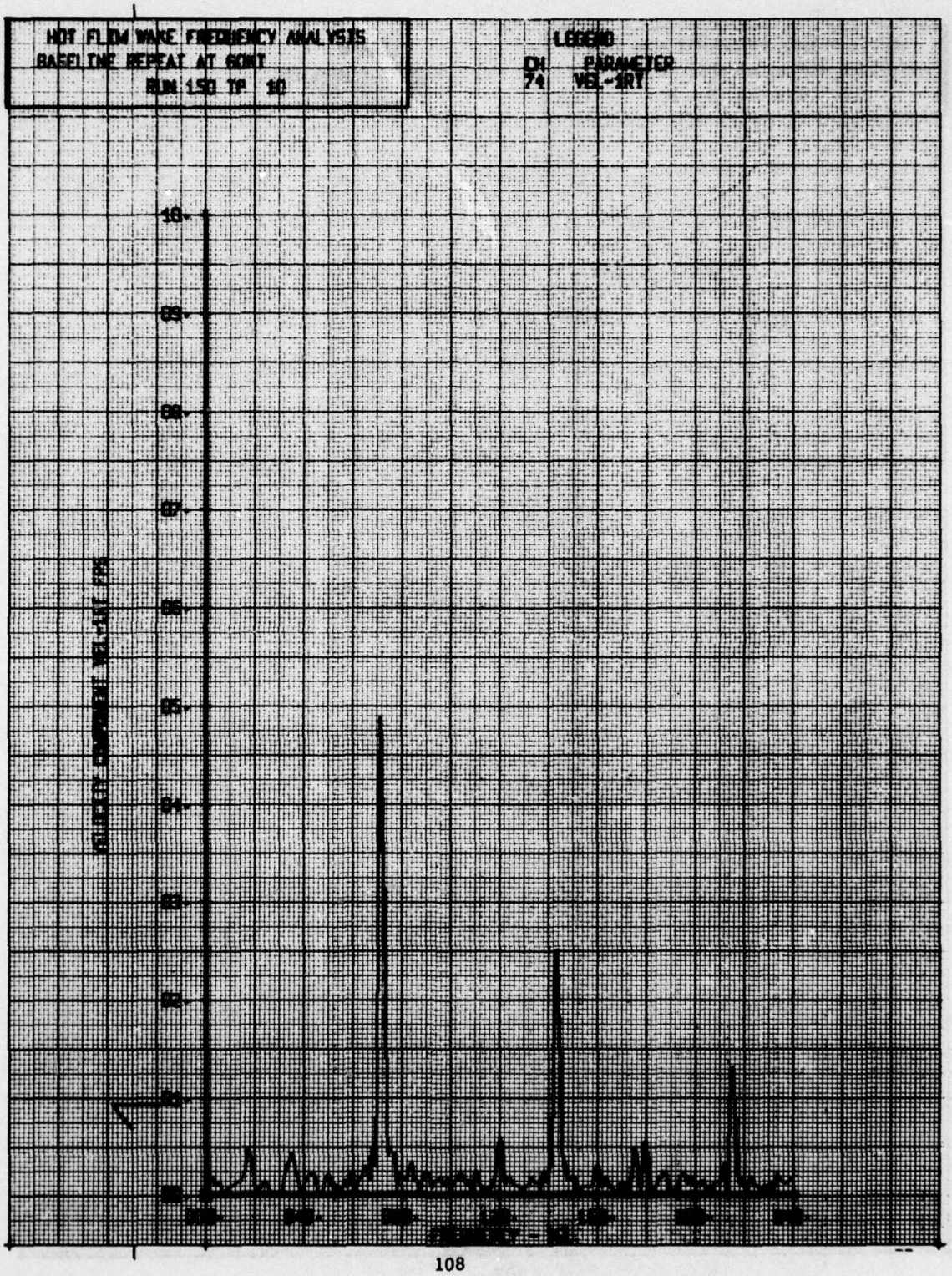
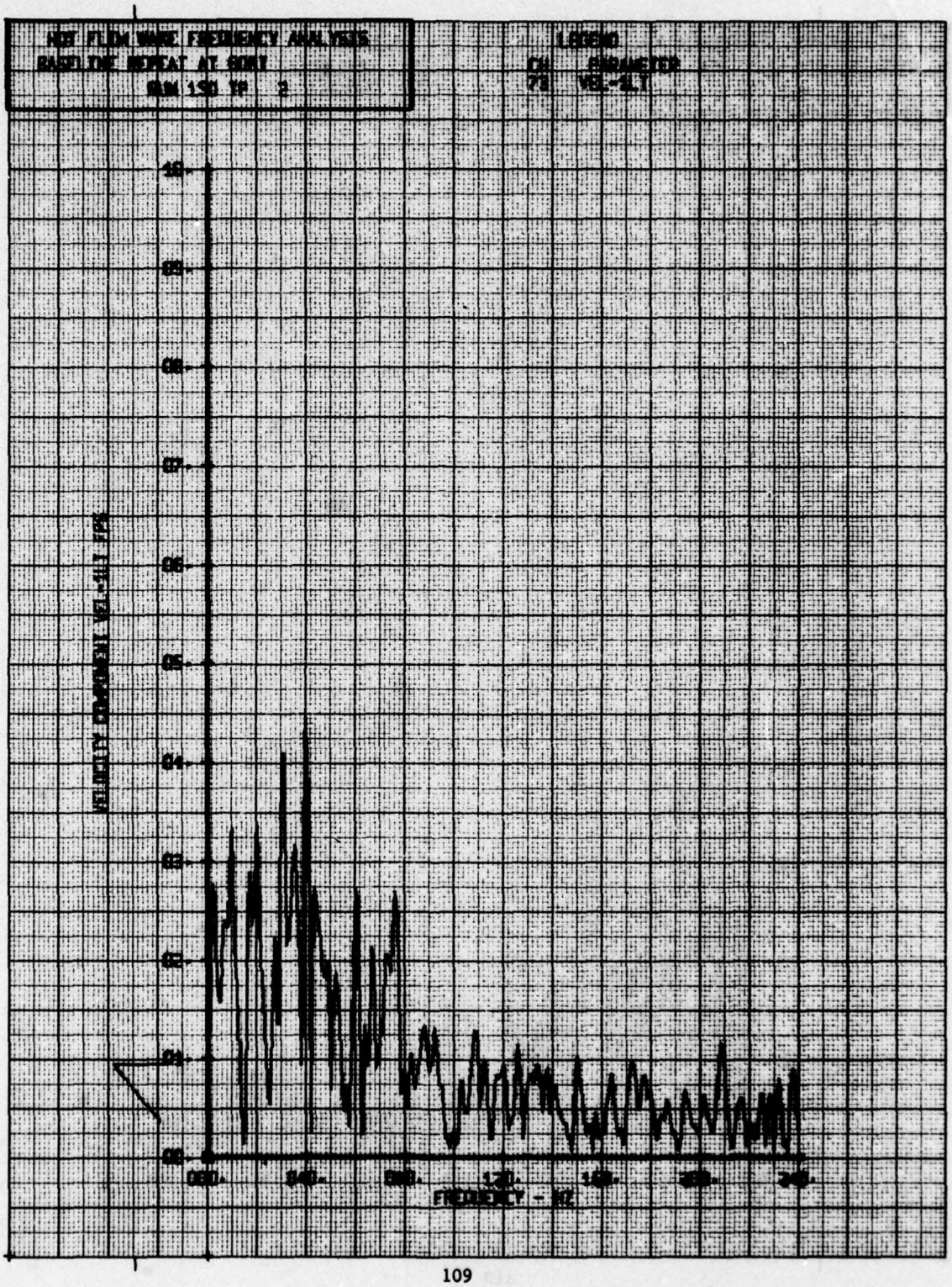
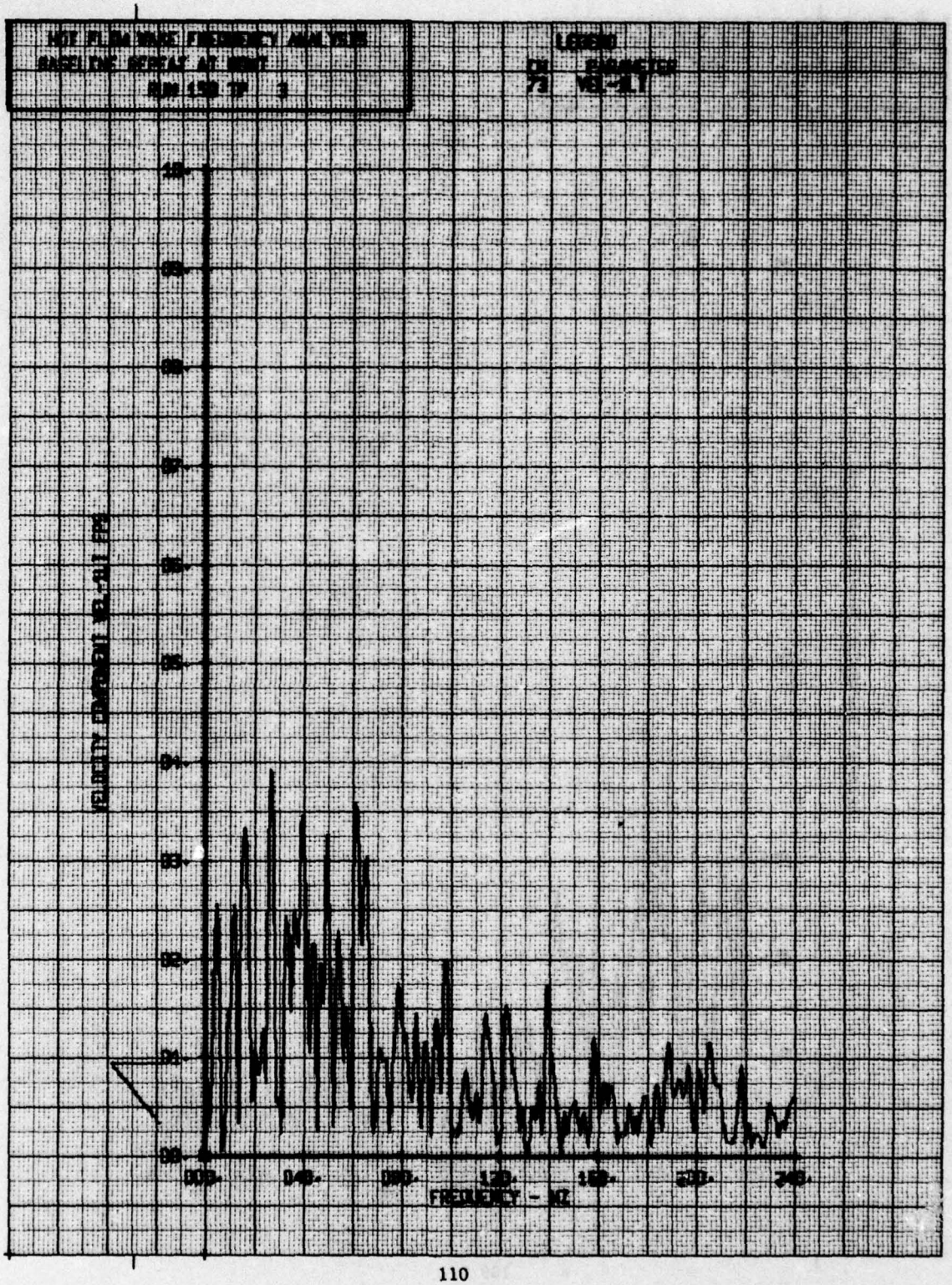
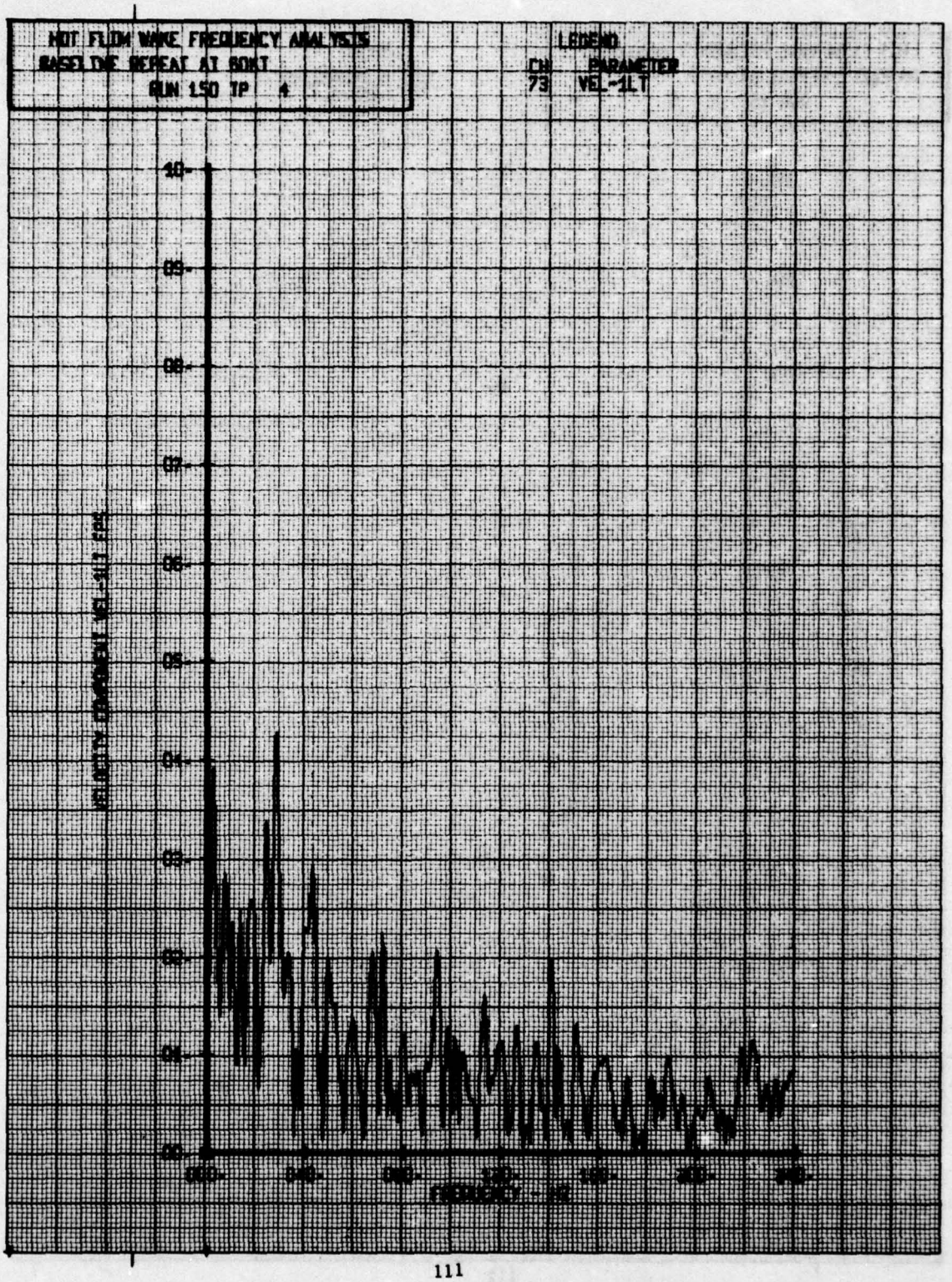
240
FREQUENCY - HZ


HOT FLOW WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 10
LEGEND
CH PARAMETER
74 VEL-1RY
FOURIER AMPLITUDE VEL-1RY FPS


HOT FILM WAKE FREQUENCY ANALYSIS
RADIUS RATIO AT 60RT
RUN 150 YP 2
LEGEND
CH PARAMETER
73 VEL-ALT
VELOCITY COMPONENT VEL-ALT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT HOST
RUN 150 TP 3
LEGEND
CH DIRECTION
73 VEL-X
FREQUENCY - HZ


HOT FLOW WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80KT
RUN 150 TP 4
LEGEND
CH PARAMETER
73 VEL-1LT
10-
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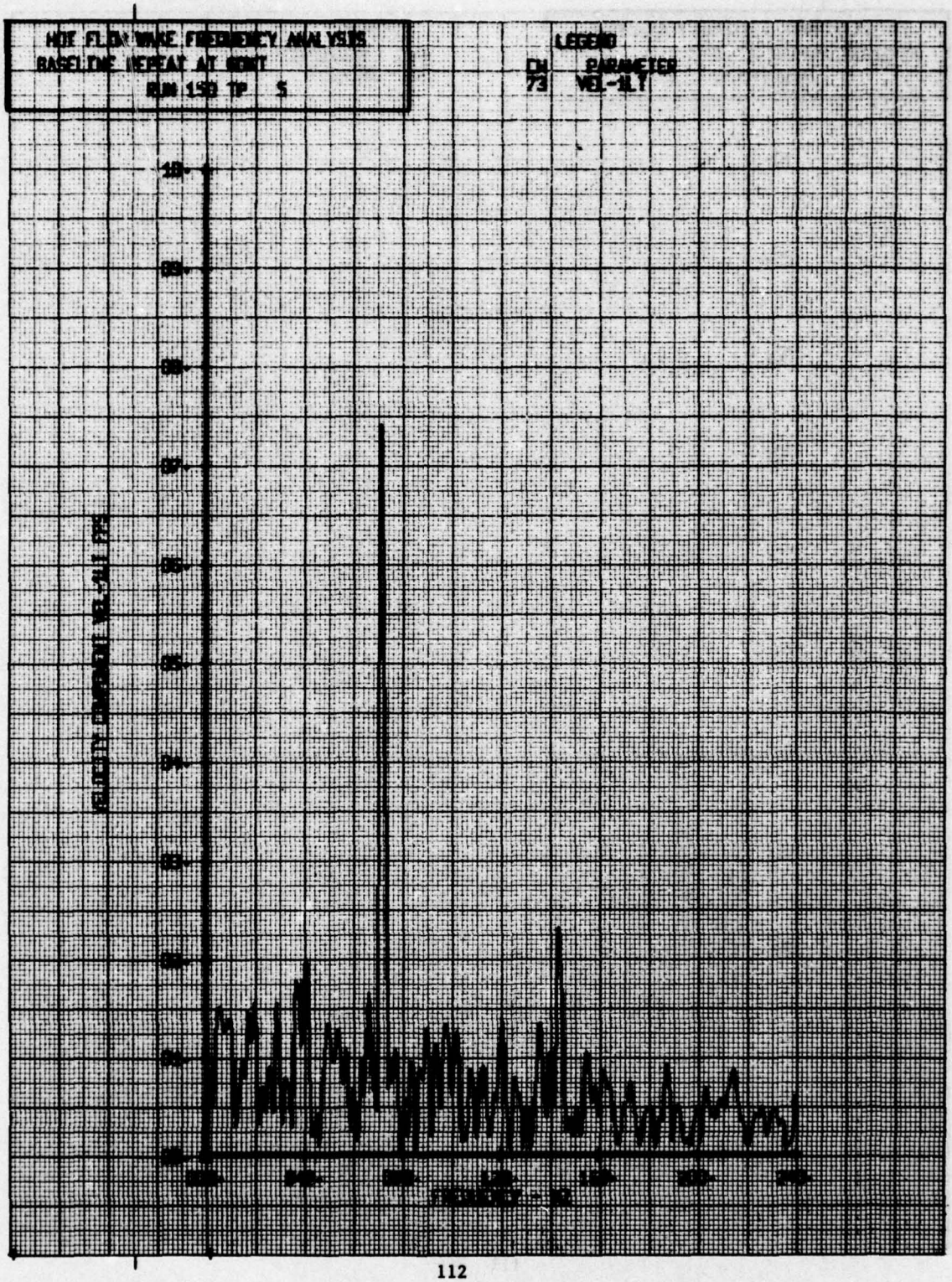
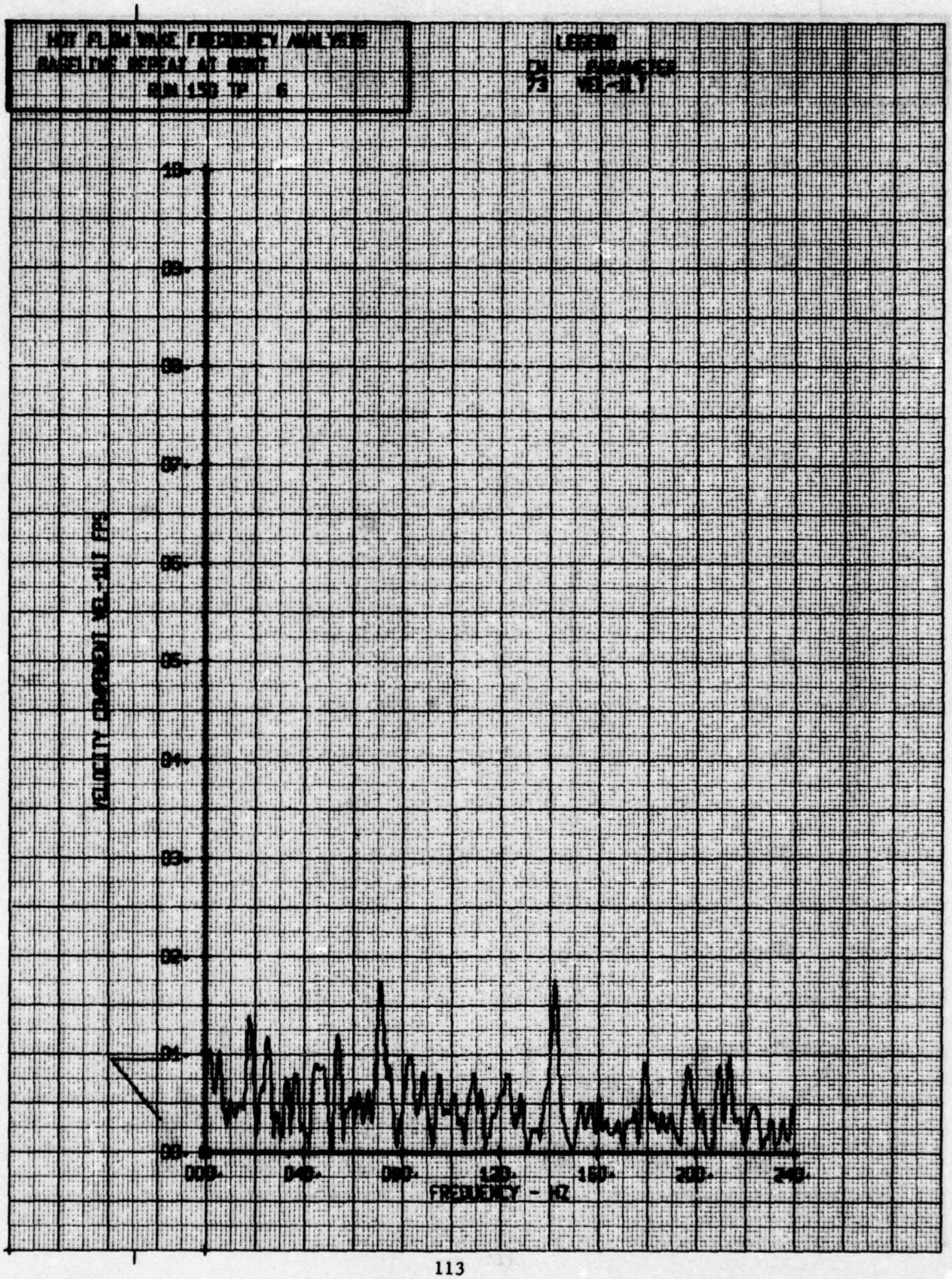
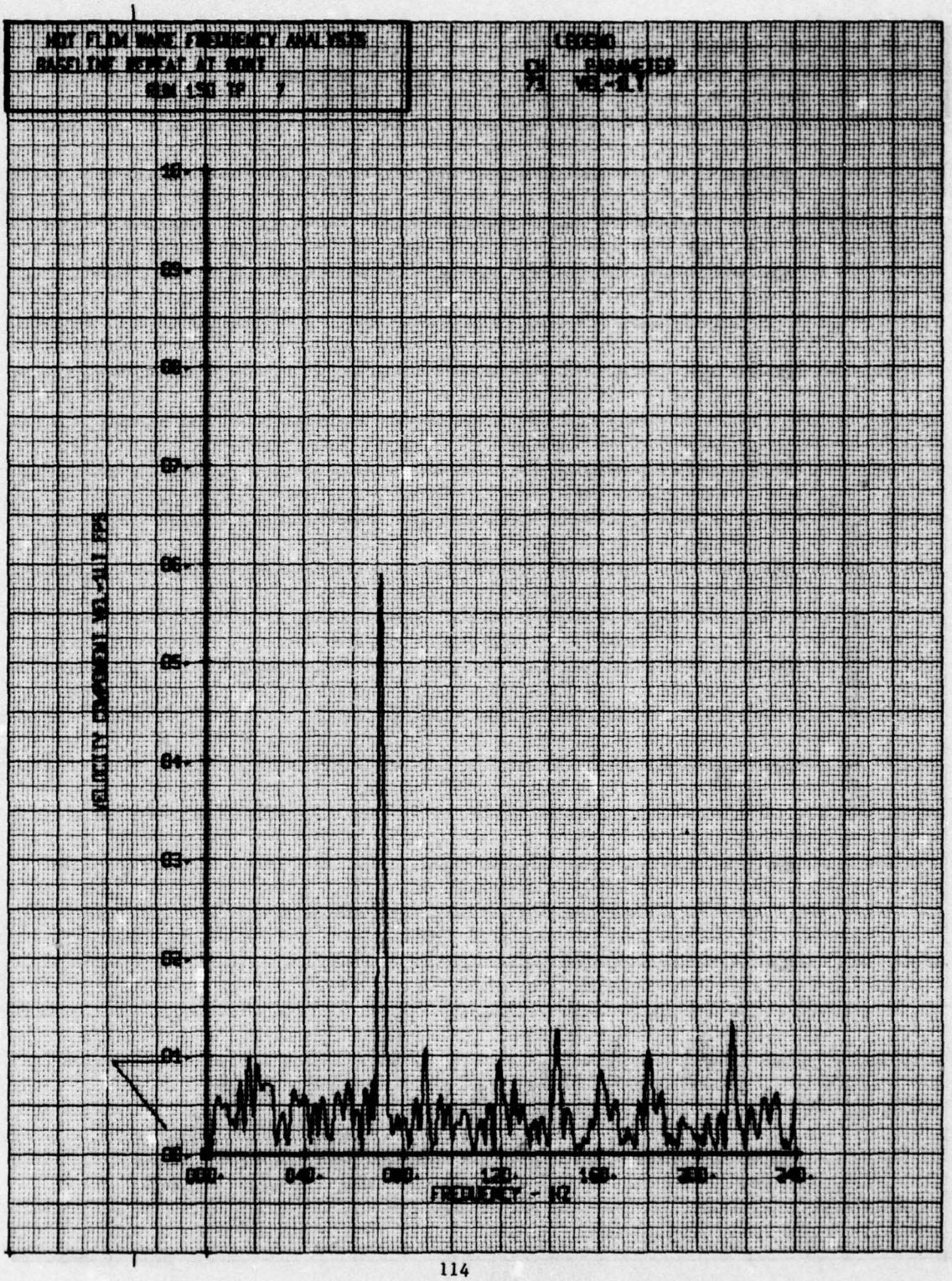
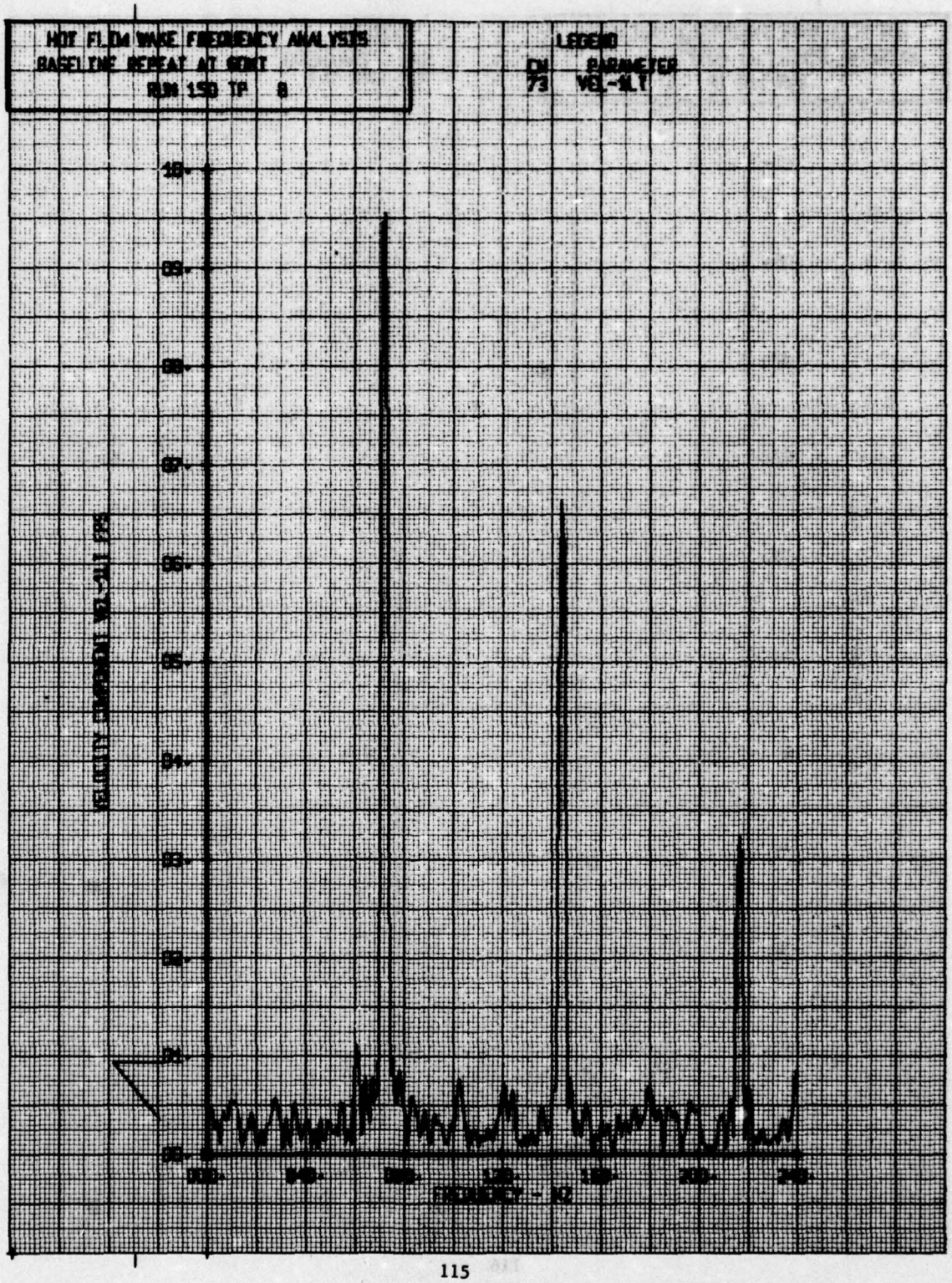
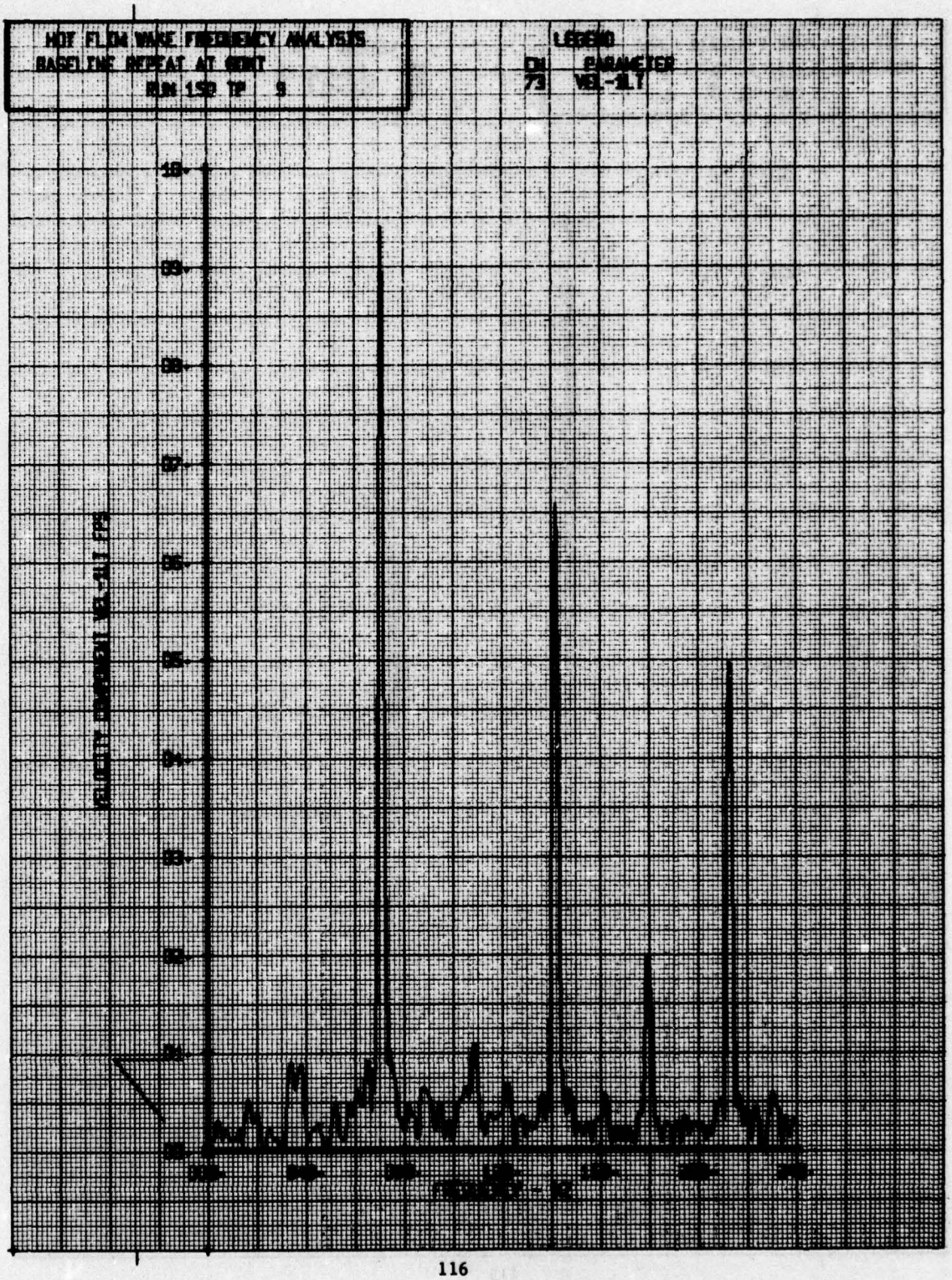
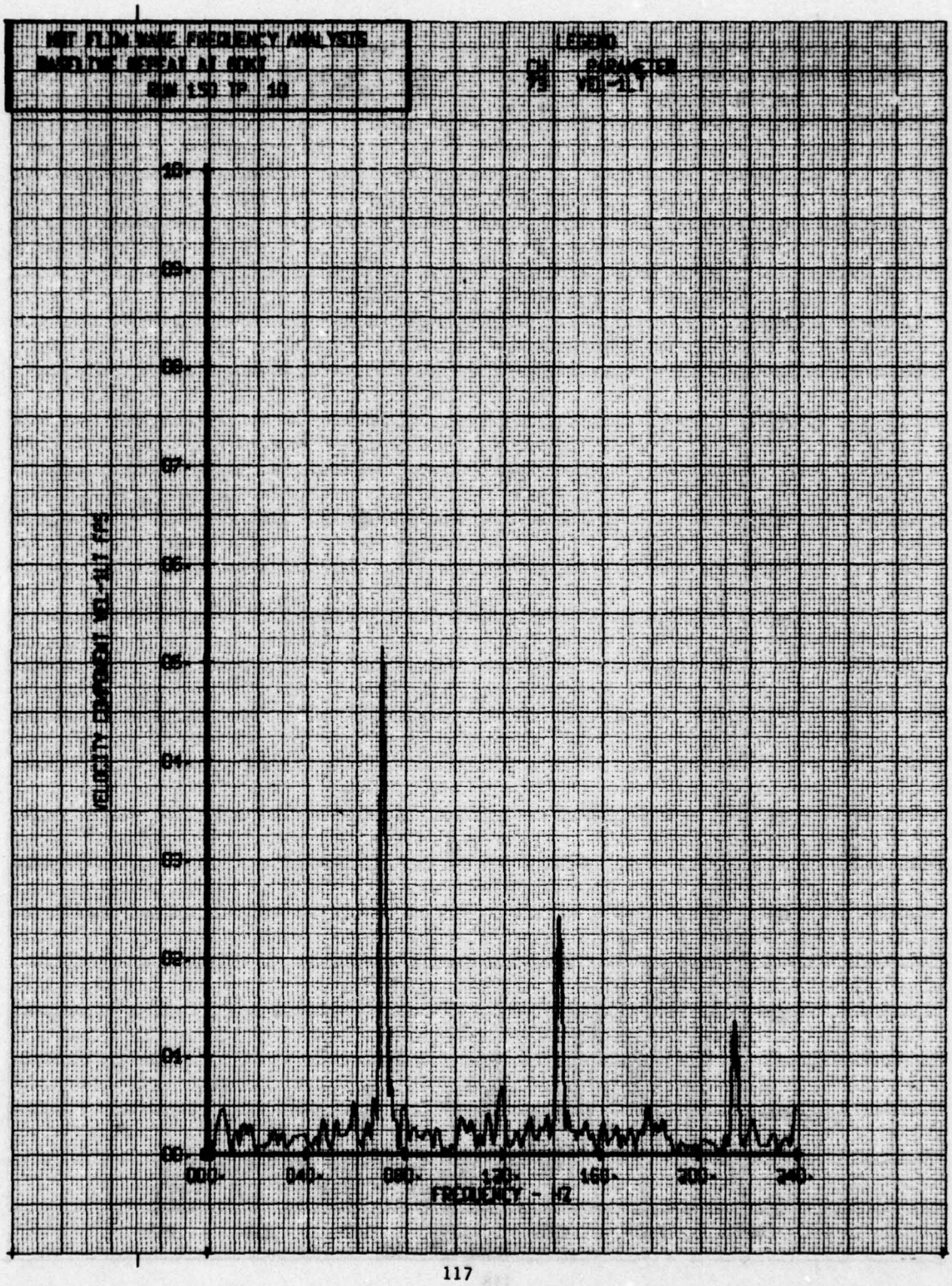

HOT FLOW WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT HOVT
RUN 150 TP 5
LEGEND
CH PARAMETER
73 VEL-ILY

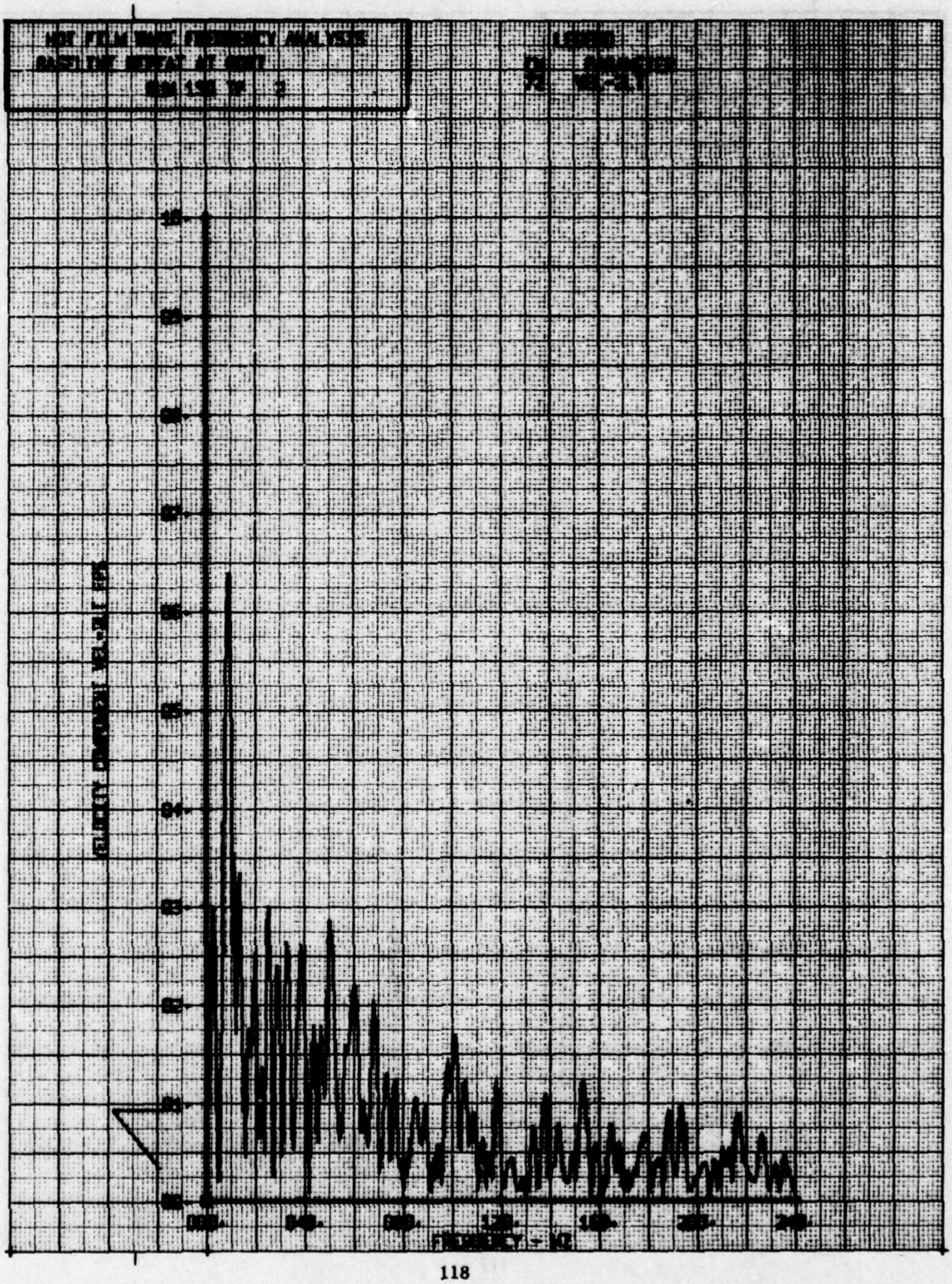

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80HT
RUN 150 TP 6
LEGEND
CH CHARACTER
73 VEL-ALT
VELOCITY COMPONENT VEL-ALT FPS
FREQUENCY - HZ

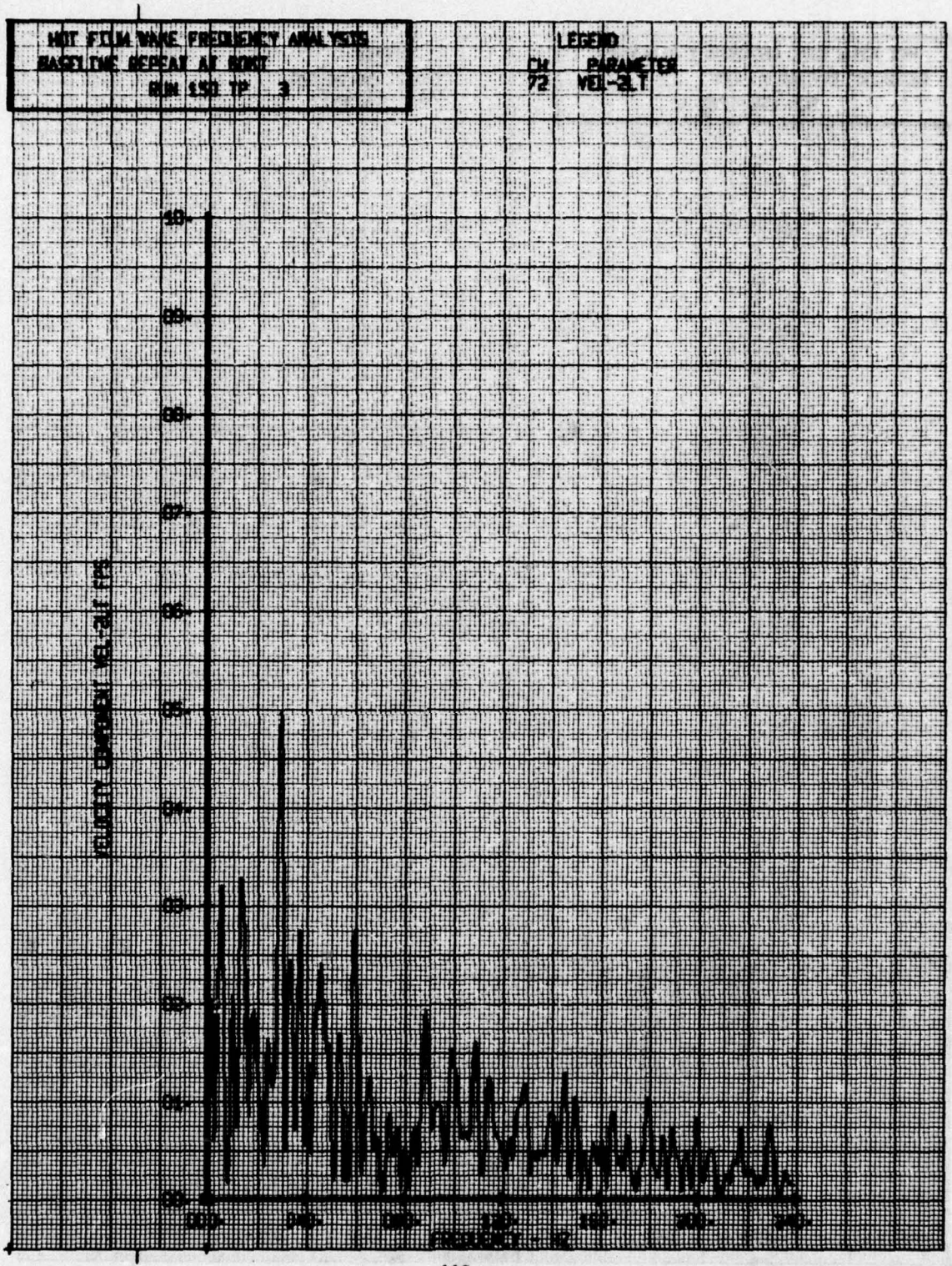

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT NOMI
RUN 150 TP 1
LEGEND
CH DIAMETER
FREQUENCY - KZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT RENT
RUN 150 TP 8
LEGEND
CH PARAMETER
73 VEL-ALT
RELATIVE AMPLITUDE VOLTS RMS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 9
LEGEND
CH PARAMETER
73 VEL-ALT


HOT FILM WAKE FREQUENCY ANALYSIS
WAKE ONE REPEAT AT 60KT
RUN 150 TP 10
LEGEND
CH CHARACTER
FREQUENCY - HZ




HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT MONT
RUN 150 TP 3
LEGEND
CH PARAMETER
72 VEL-2LT
10
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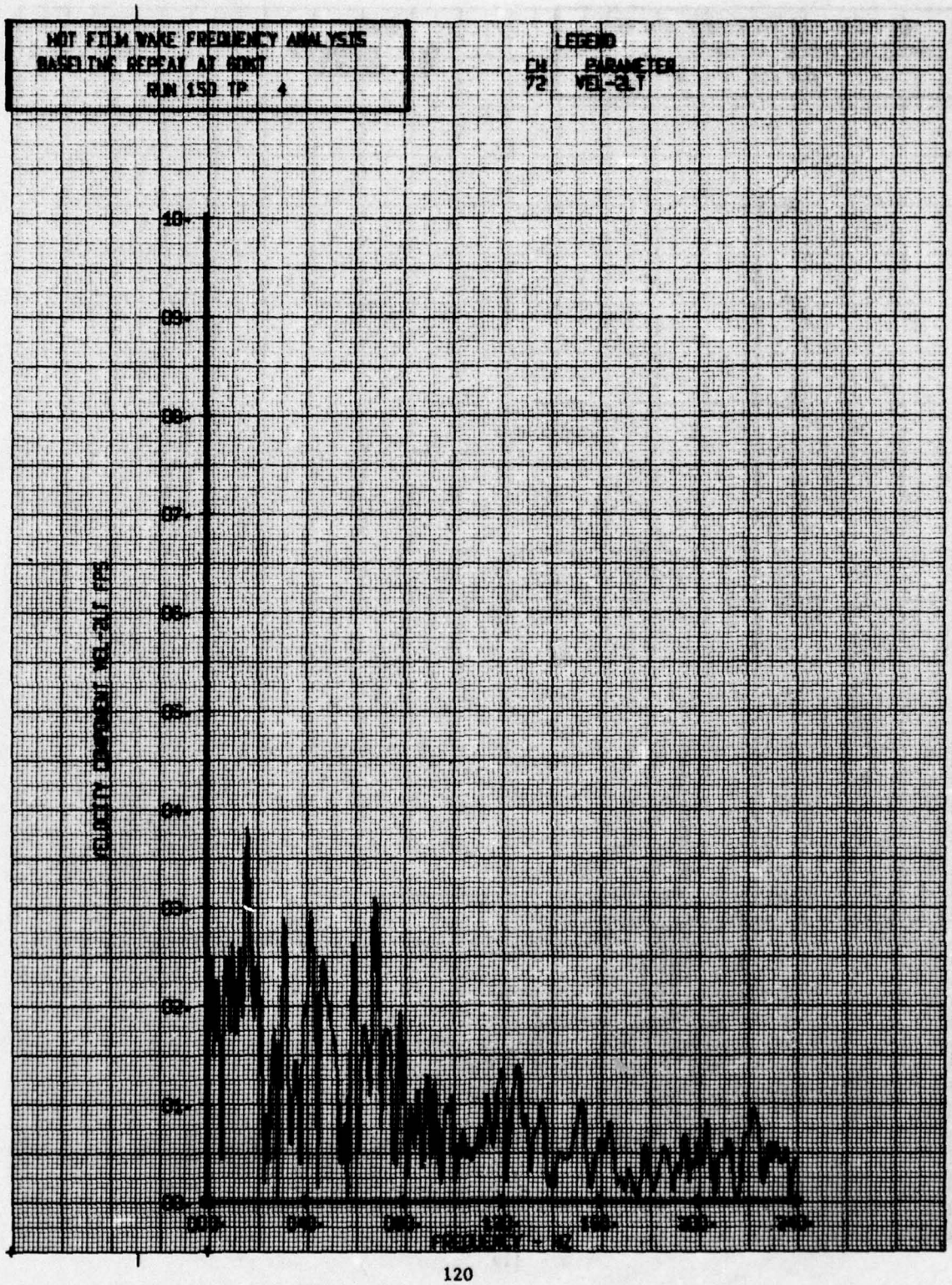
VELOCITY COMPONENT VEL-2LT FPS


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT HUNT
RUN 150 TP 4
LEGEND
CH PARAMETER
72 VEL-2LT
10
09
08
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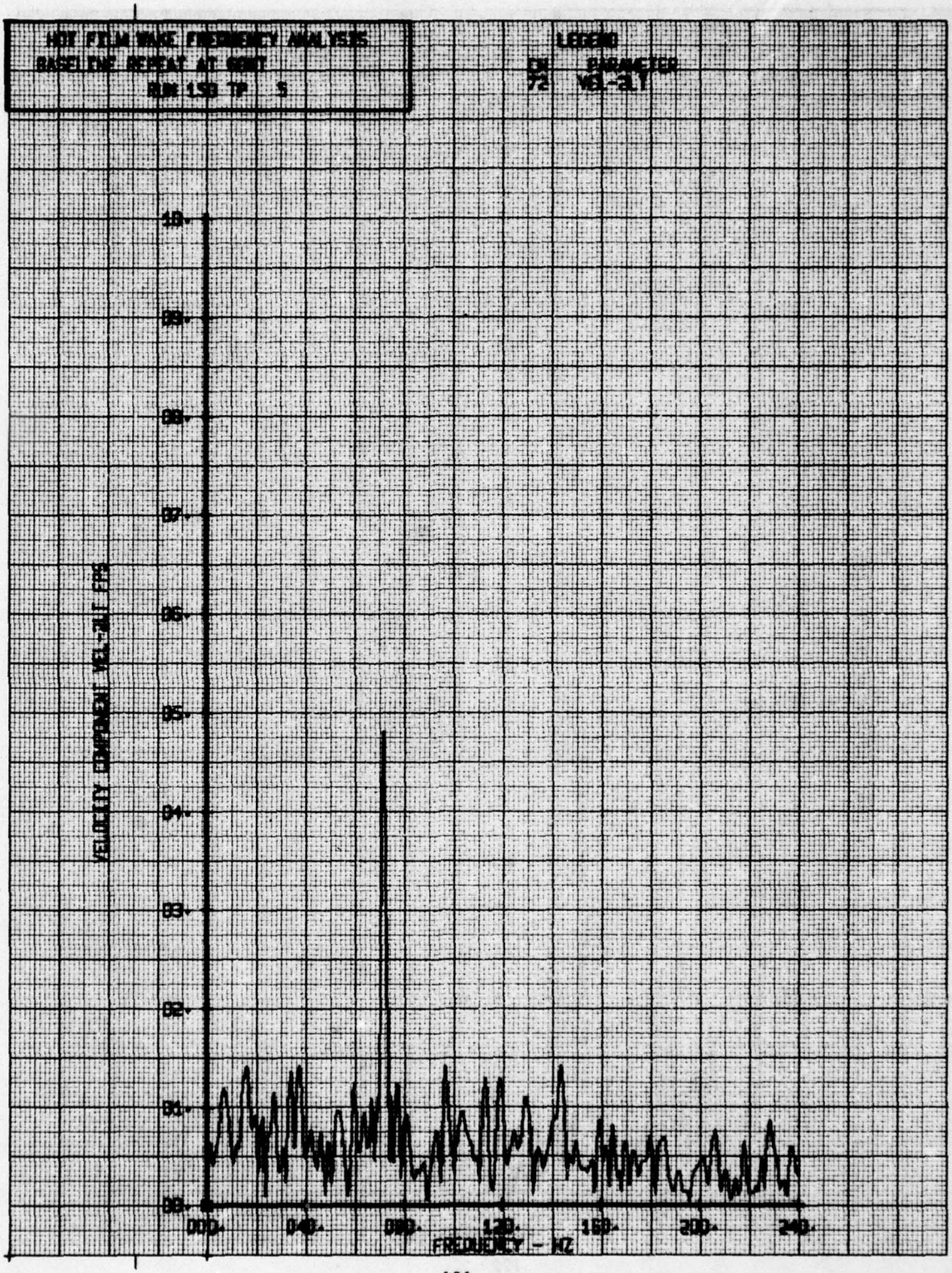
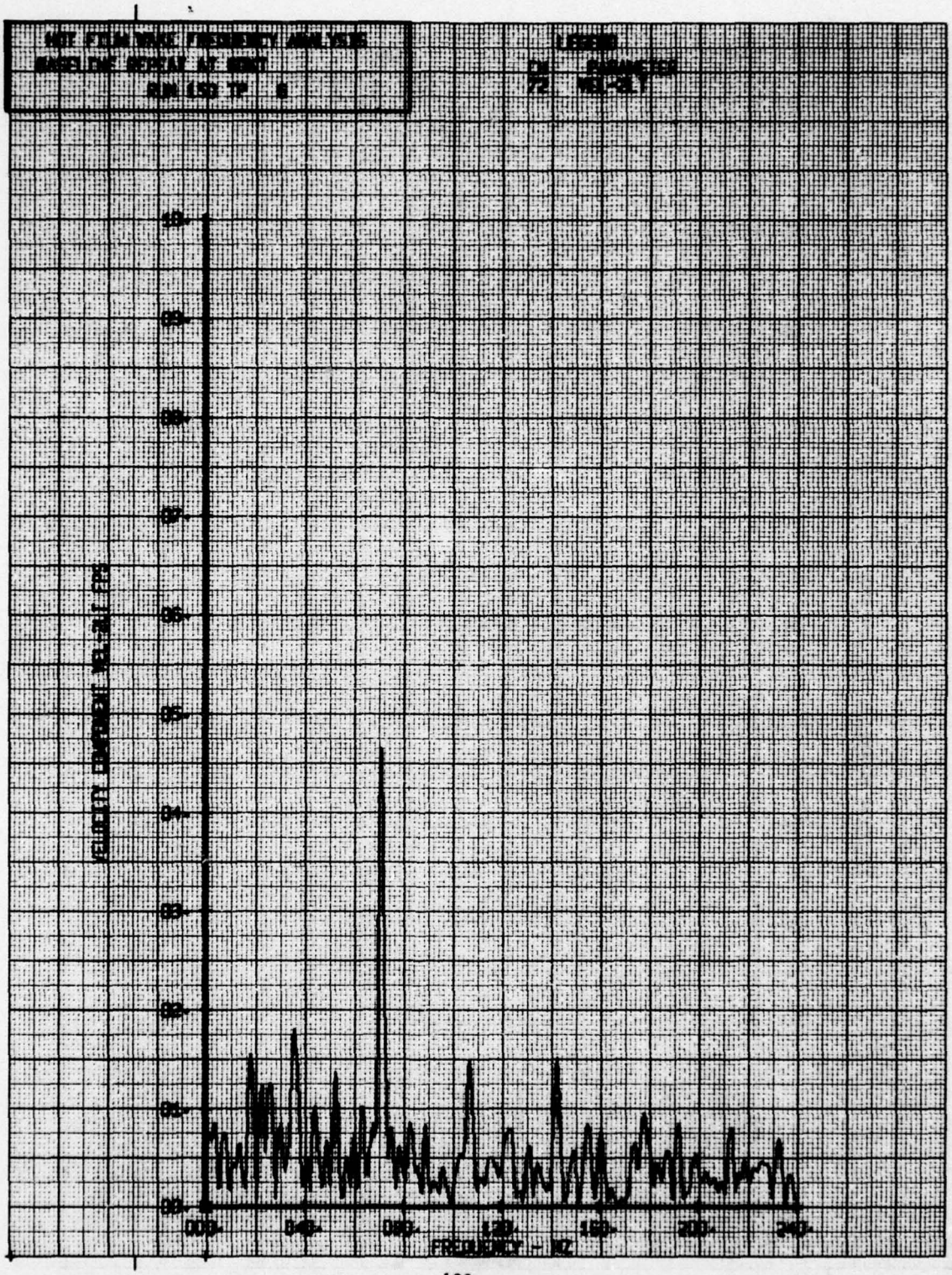
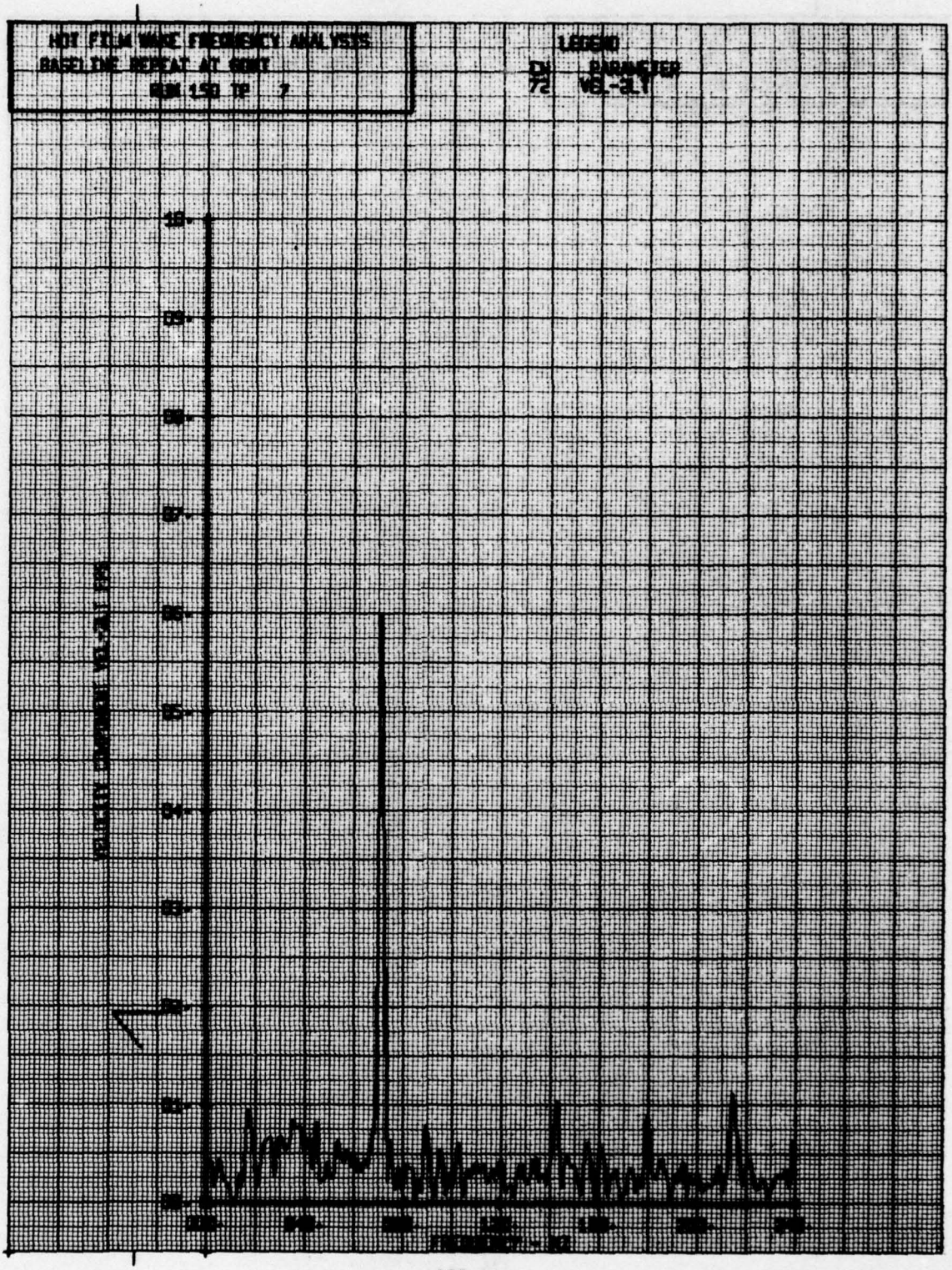
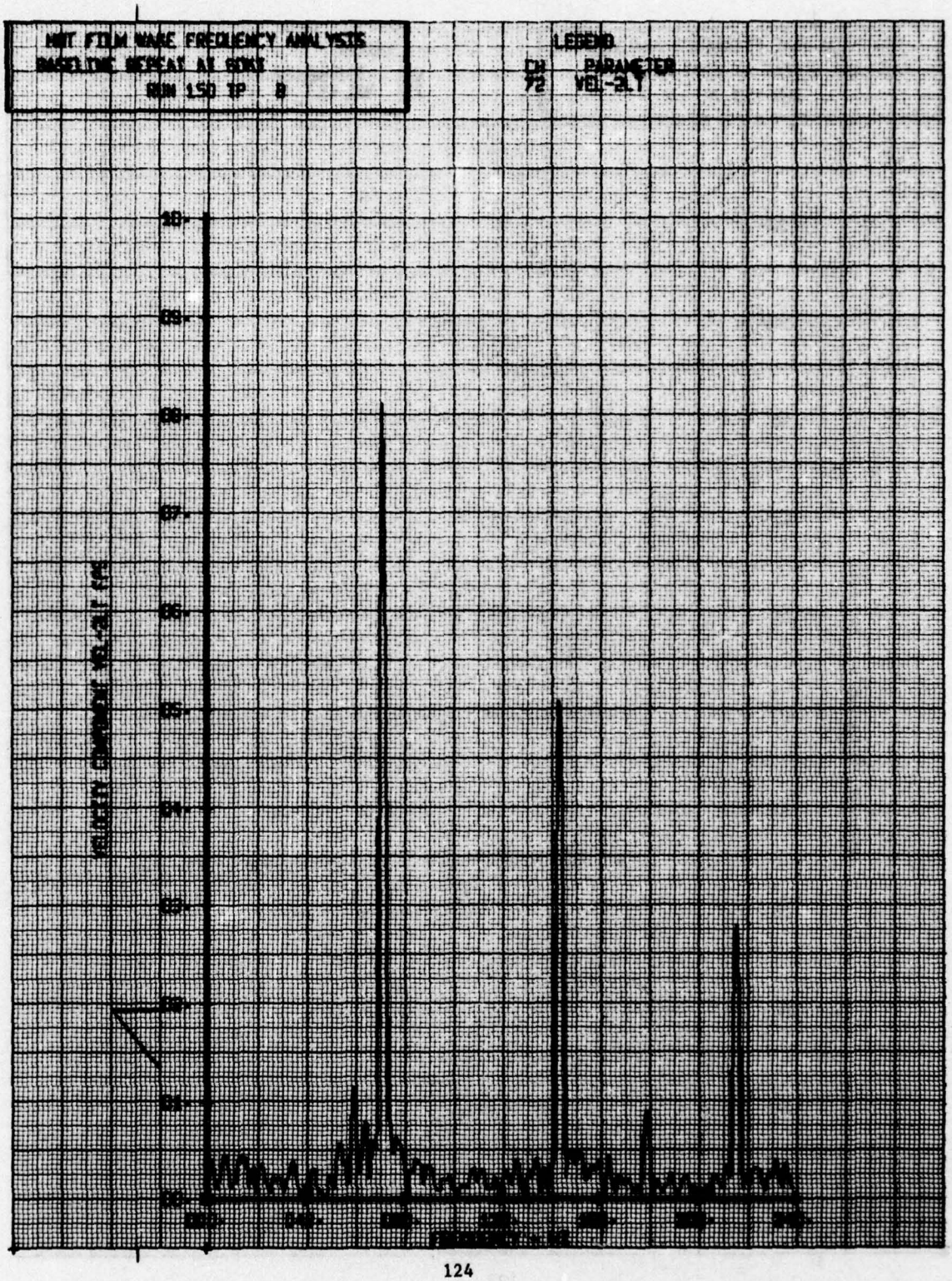
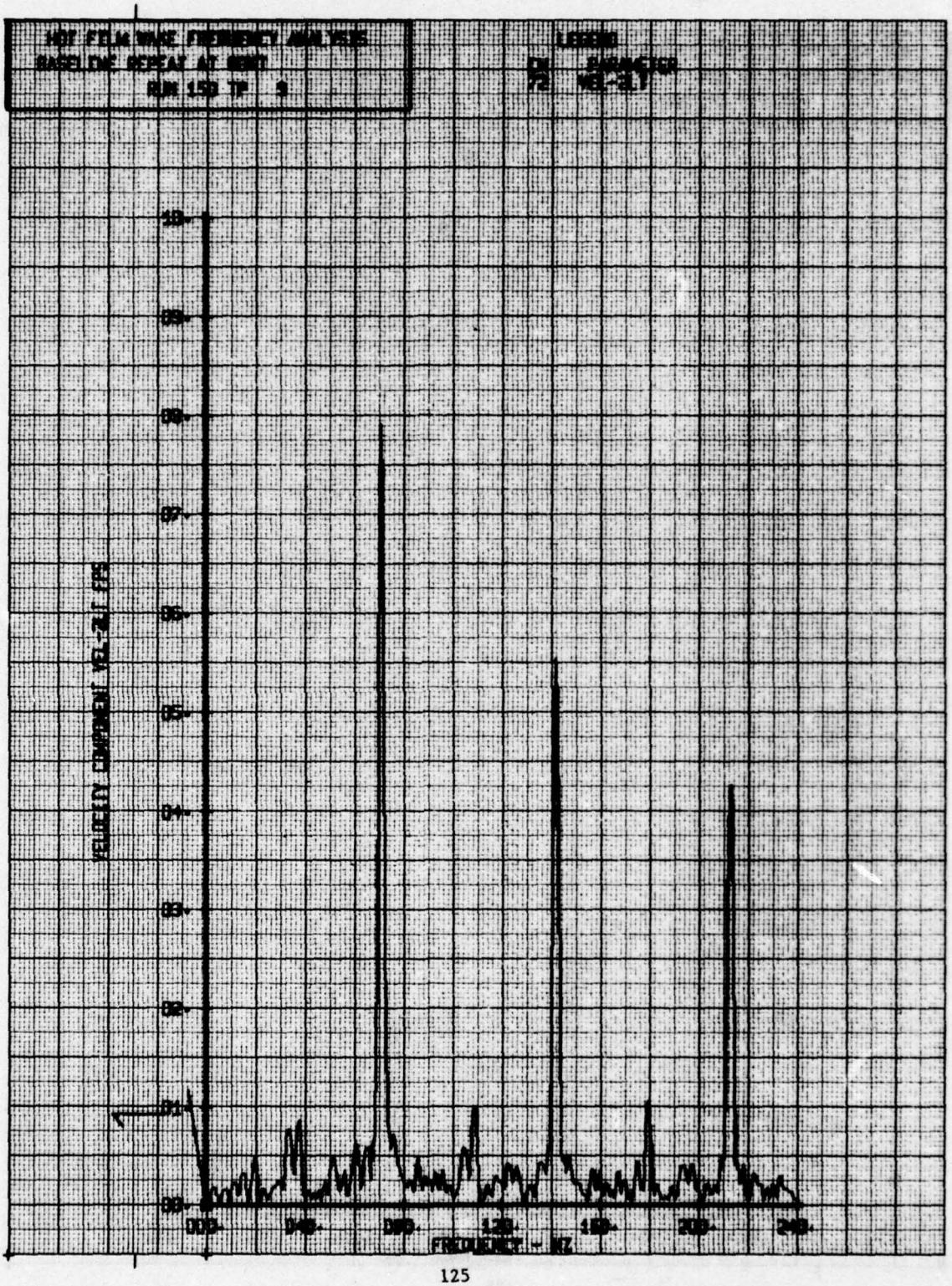
00
VELOCITY (RMS) VEL-2LT FPS

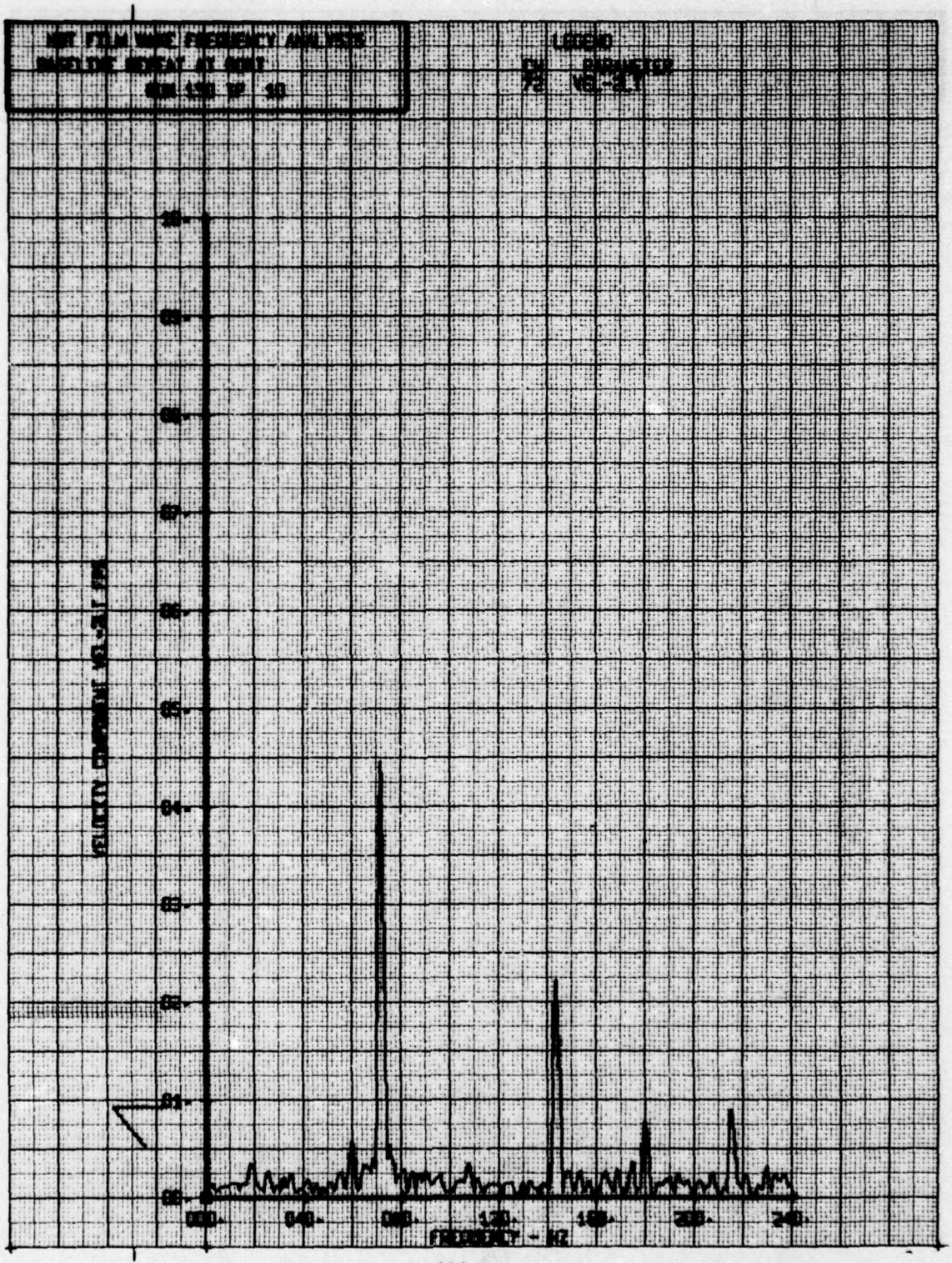

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 90DT
RUN 159 TP 5
LEGEND
CH PARAMETER
72 V8.-3.Y
VELOCITY COMPONENT V8.-24.F FPS
FREQUENCY - HZ

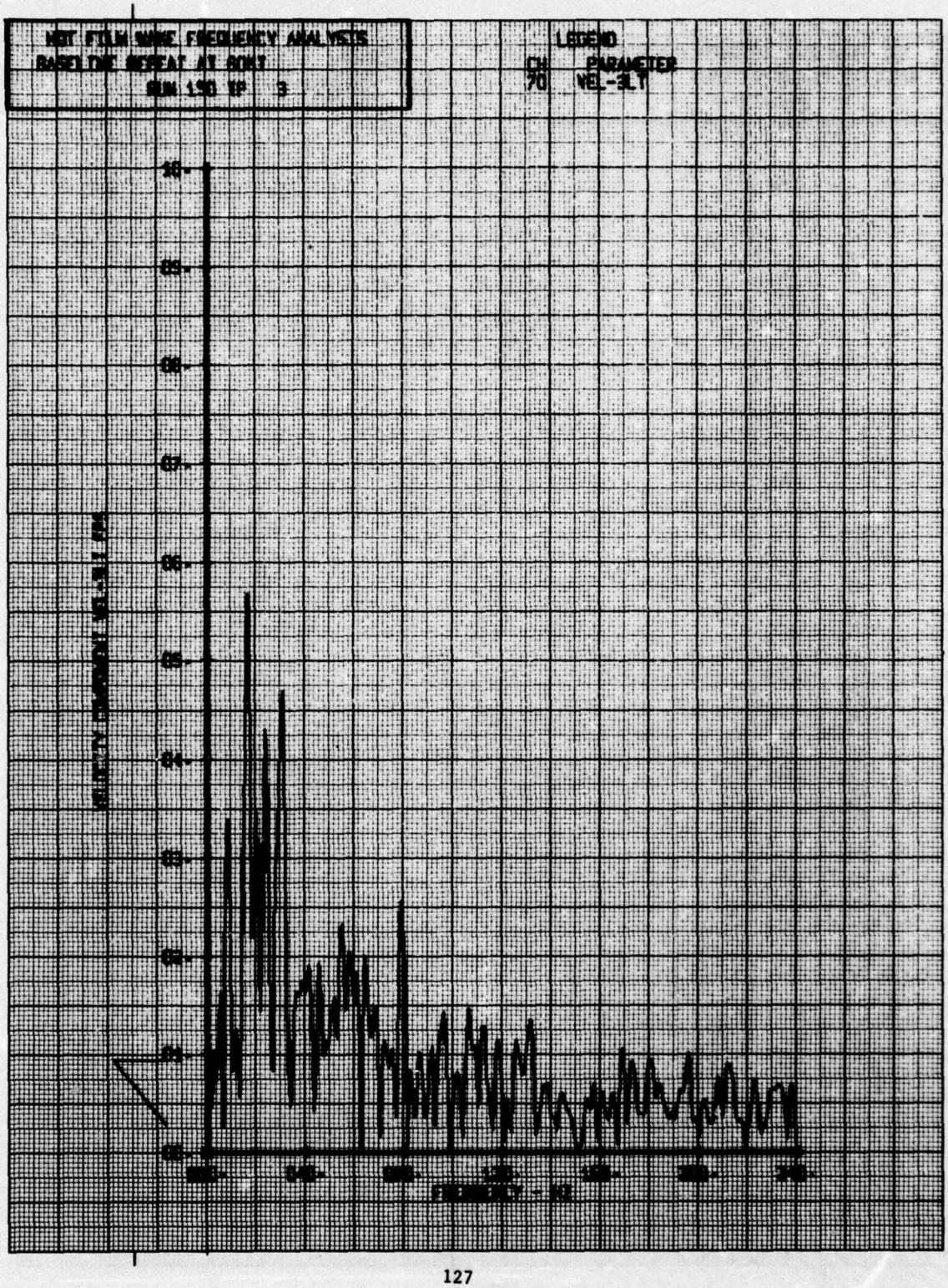

FREQUENCY - HZ

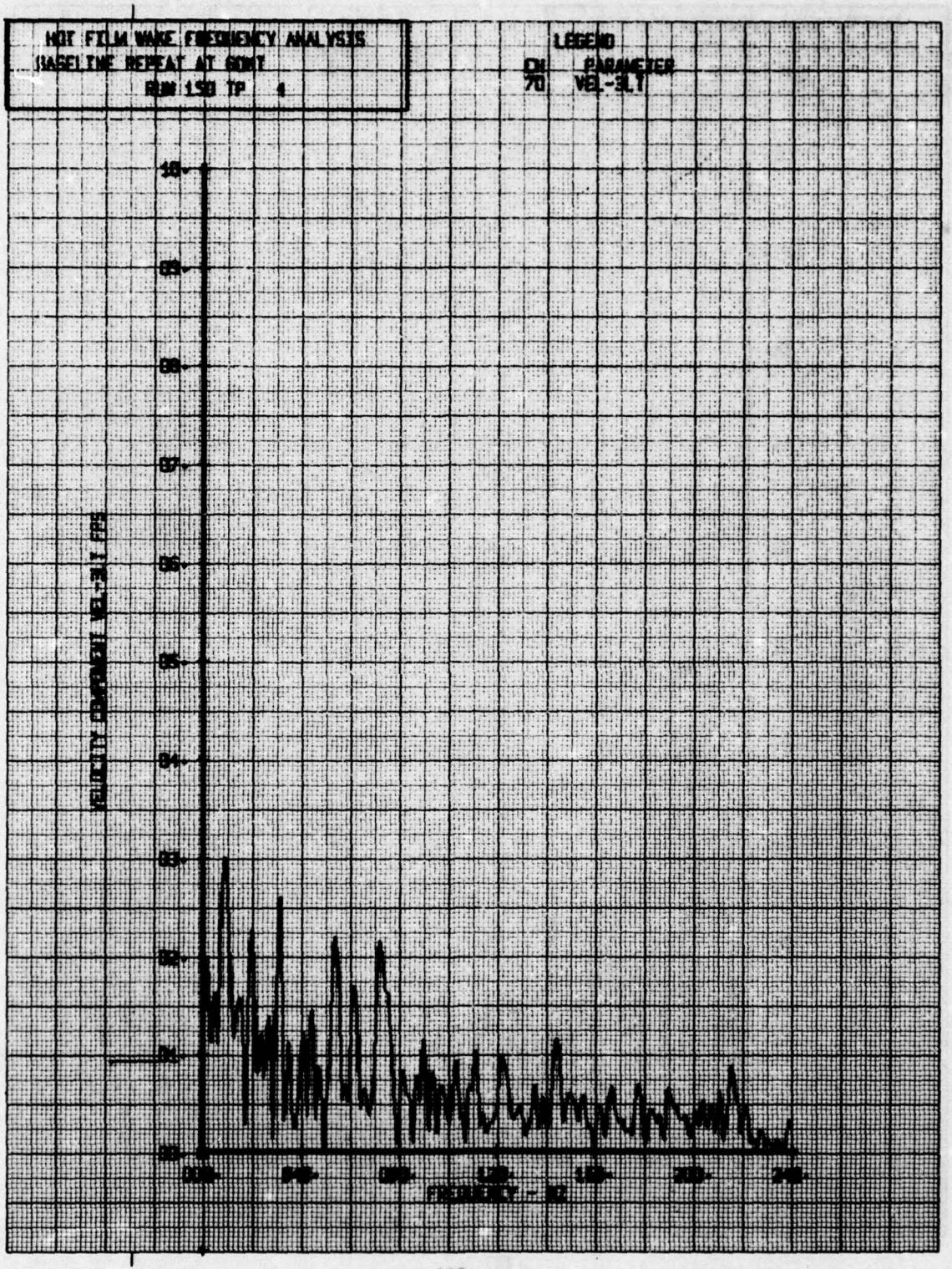

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 7
LEGEND
CH PARAMETER
72 VEL-2.1
POWER SPECTRAL DENSITY, VOLTS**2/HZ

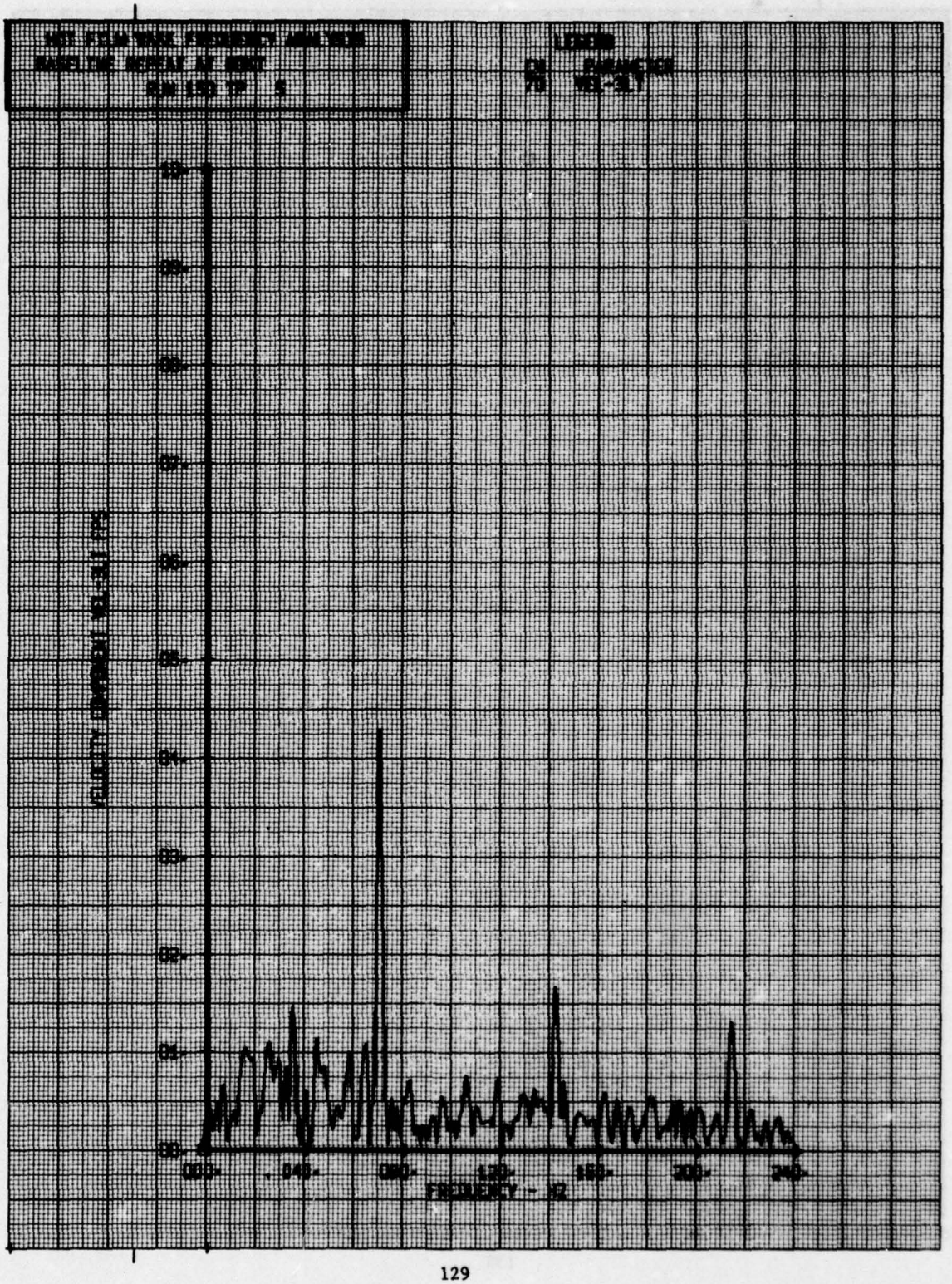

MIT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 8
LEGEND
CH PARAMETER
72 VEL-2LT
VELOCITY COMPONENT VEL-2LT FPS
90
89
88
87
86
85
84
83
82
81
80

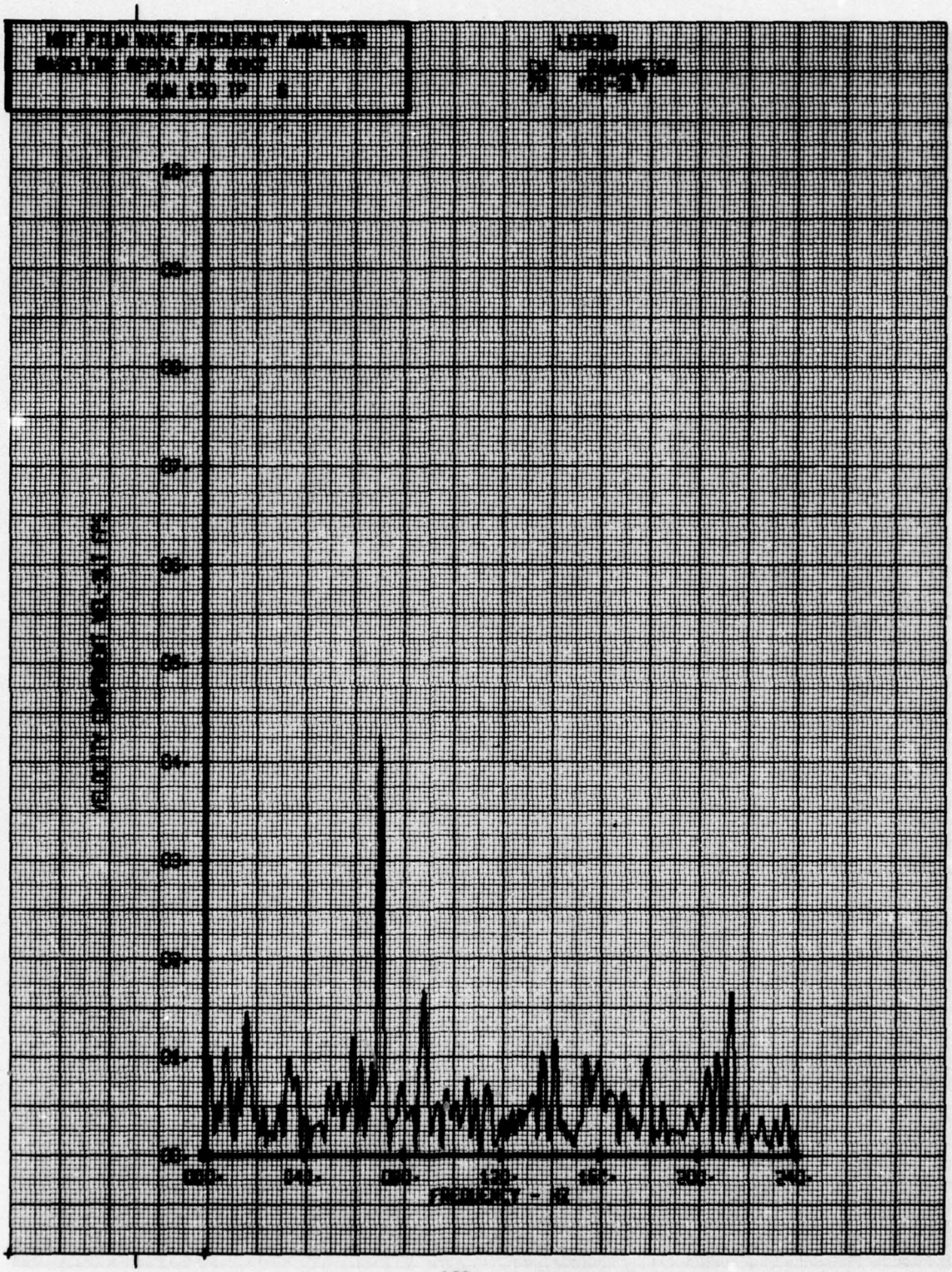

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT HOST
RUN 150 TP 9
LEGEND
PARAMETER
VELOCITY COMPONENT VEL-ALF FPS
FREQUENCY - HZ

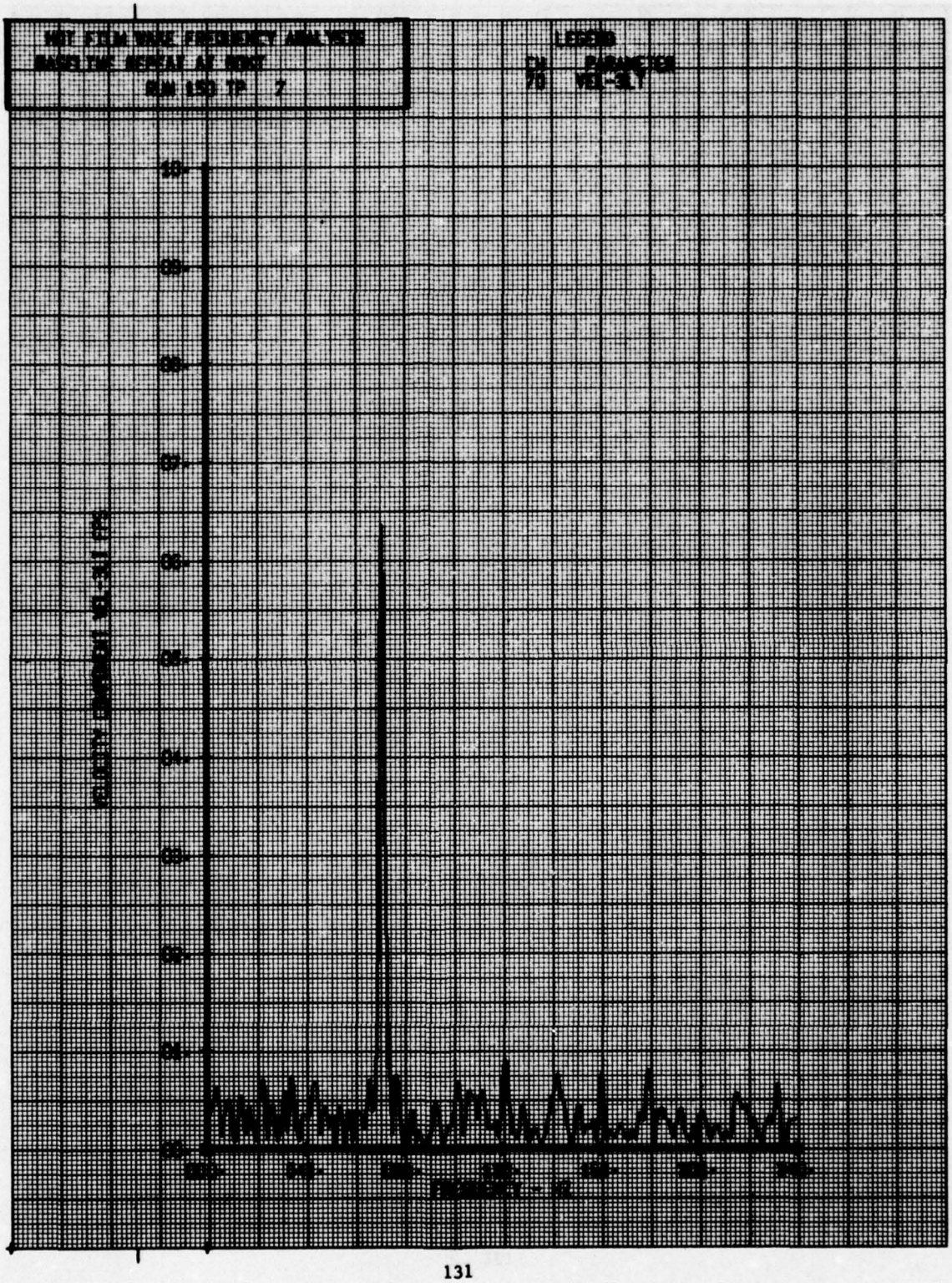


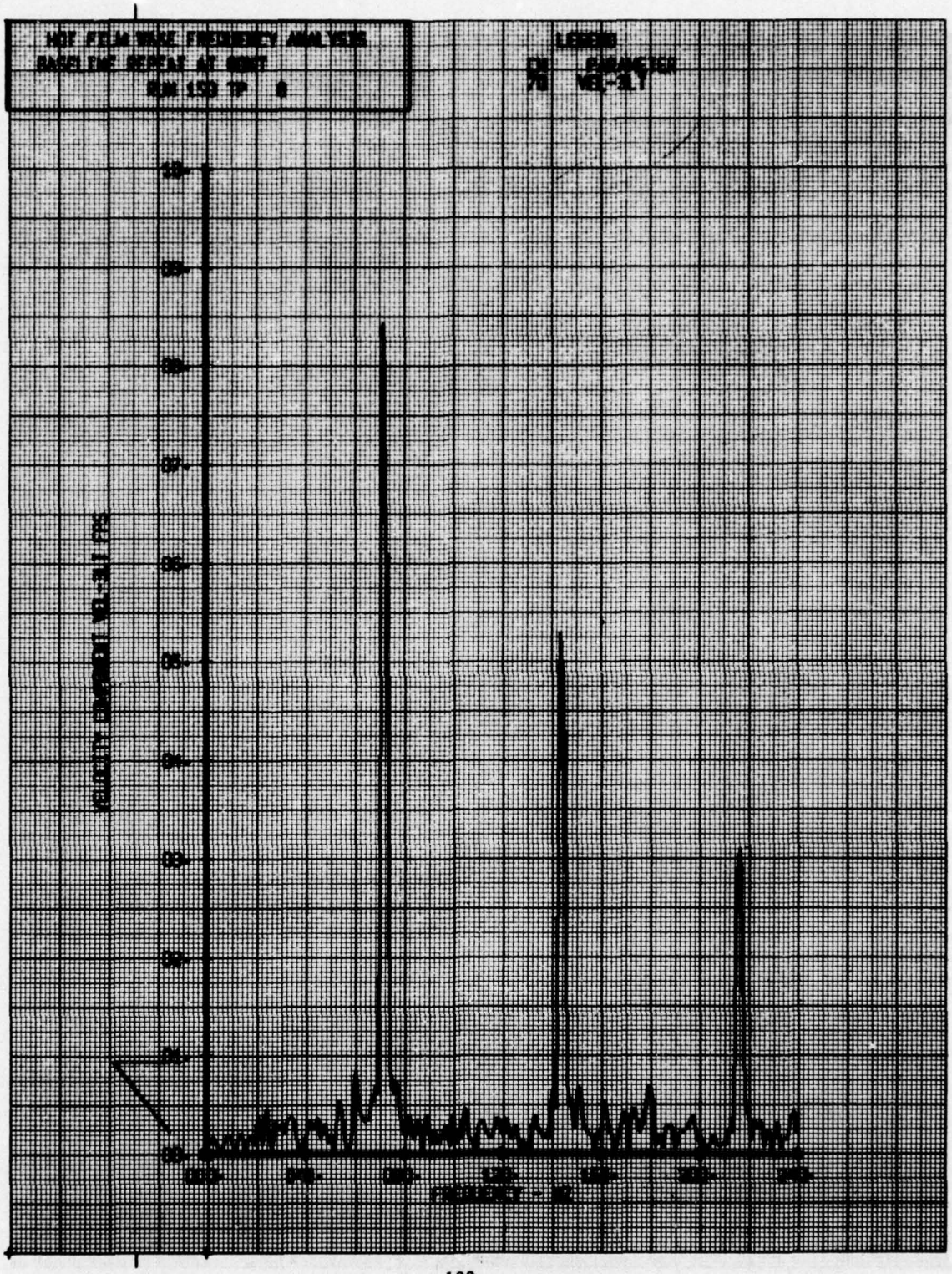

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT RUN
RUN 130 TP 3
LEGEND
CH PARAMETER
70 VEL-3LT

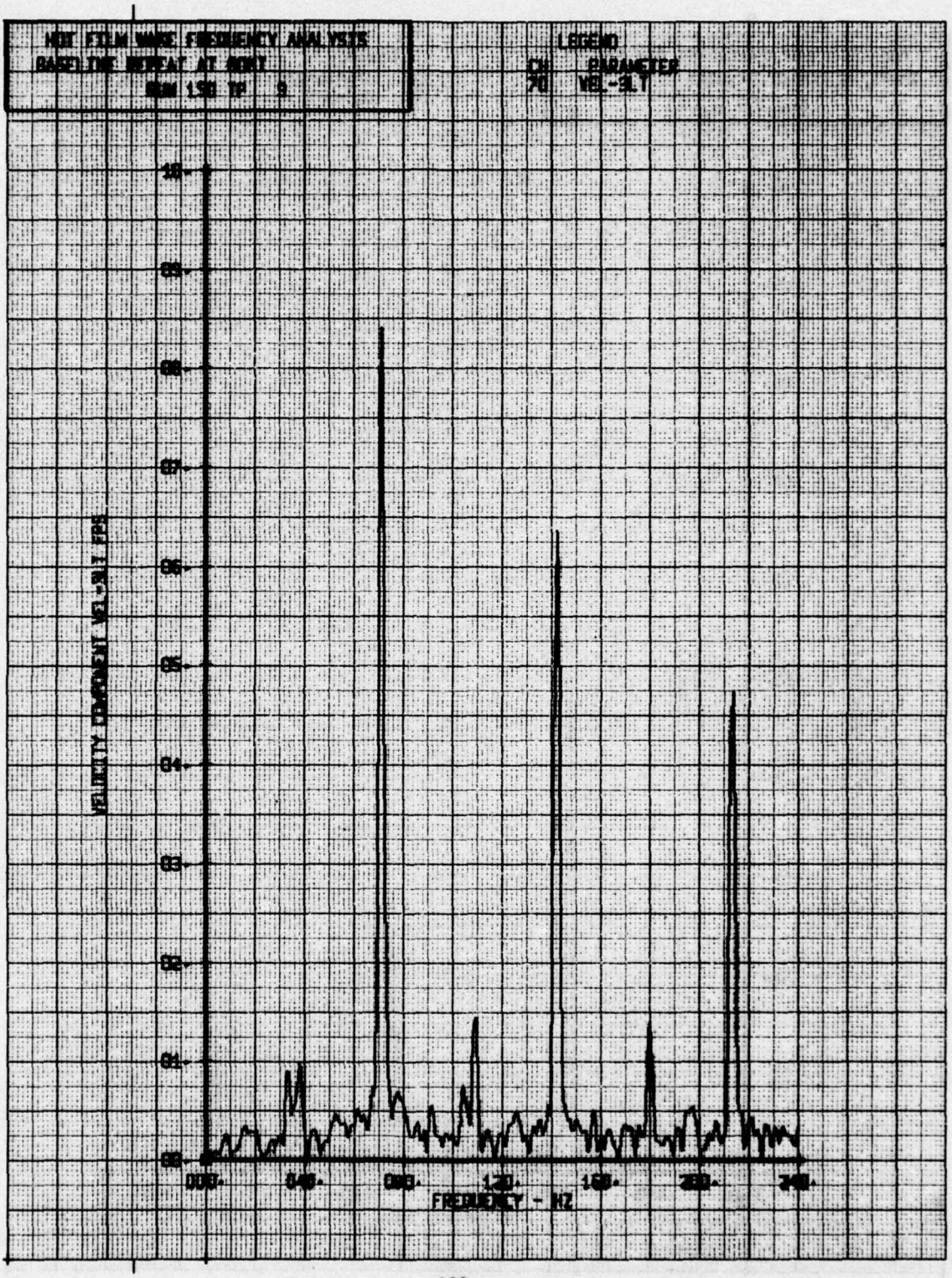

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 4
LEGEND
CH PARAMETER
70 VEL-3LT
FREQUENCY - HZ

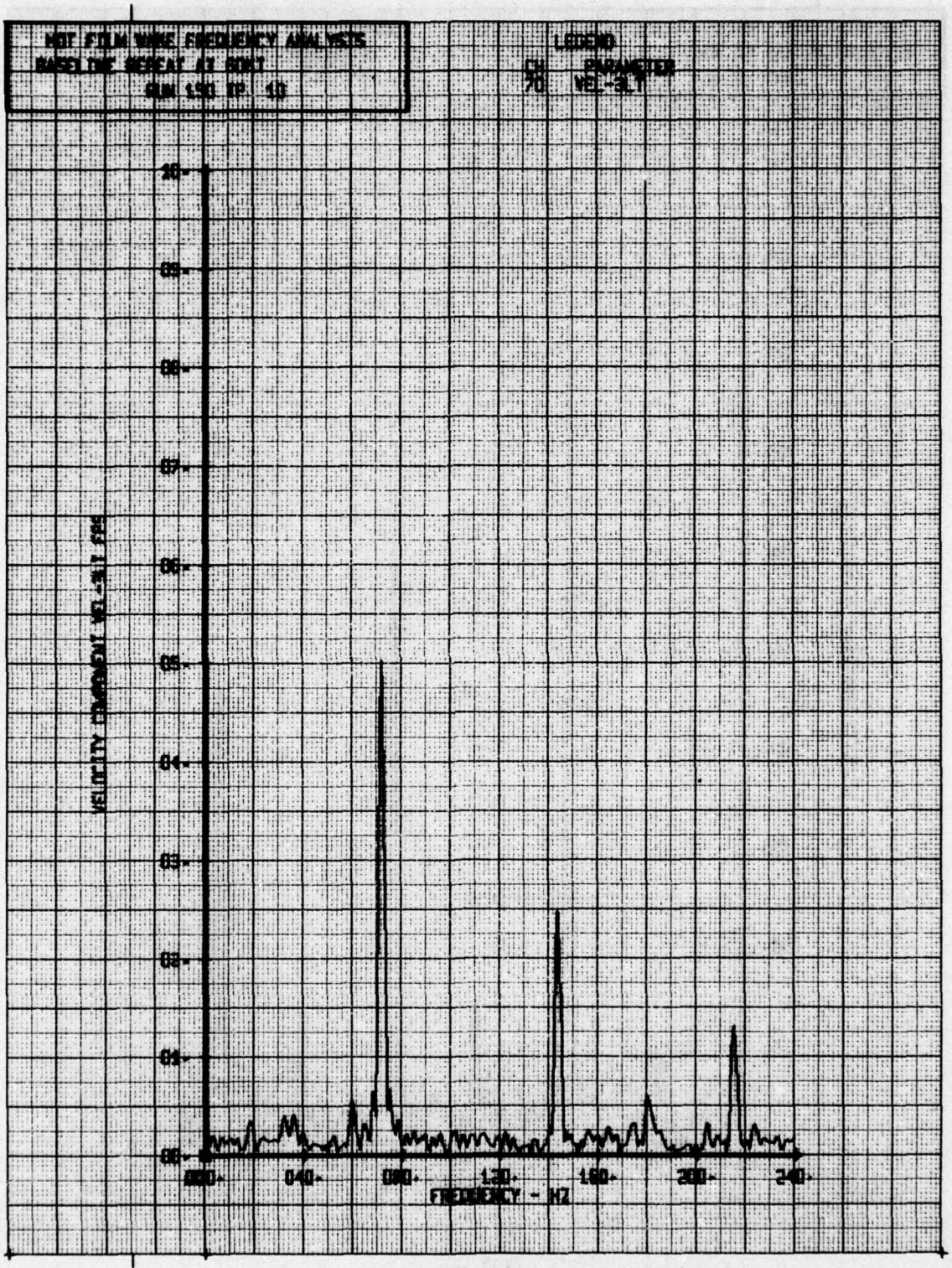

FREQUENCY - HZ




HOT FILM WAKE FREQUENCY ANALYSIS
RUN 650 TP 2
LEGEND
VEL-SLY




HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
CH PARAMETER
20 VEL-3LY
VELOCITY COMPONENT VEL-3LY FPS
FREQUENCY - HZ


HOT FILM WIRE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80KT
RUN 150 TP 10
LEGEND
CH PARAMETER
70 VEL-3LT
VELOCITY CHANNEL VEL-3LT FOR
10-
09-
08-
07-
06-
05-
04-
03-
02-
01-
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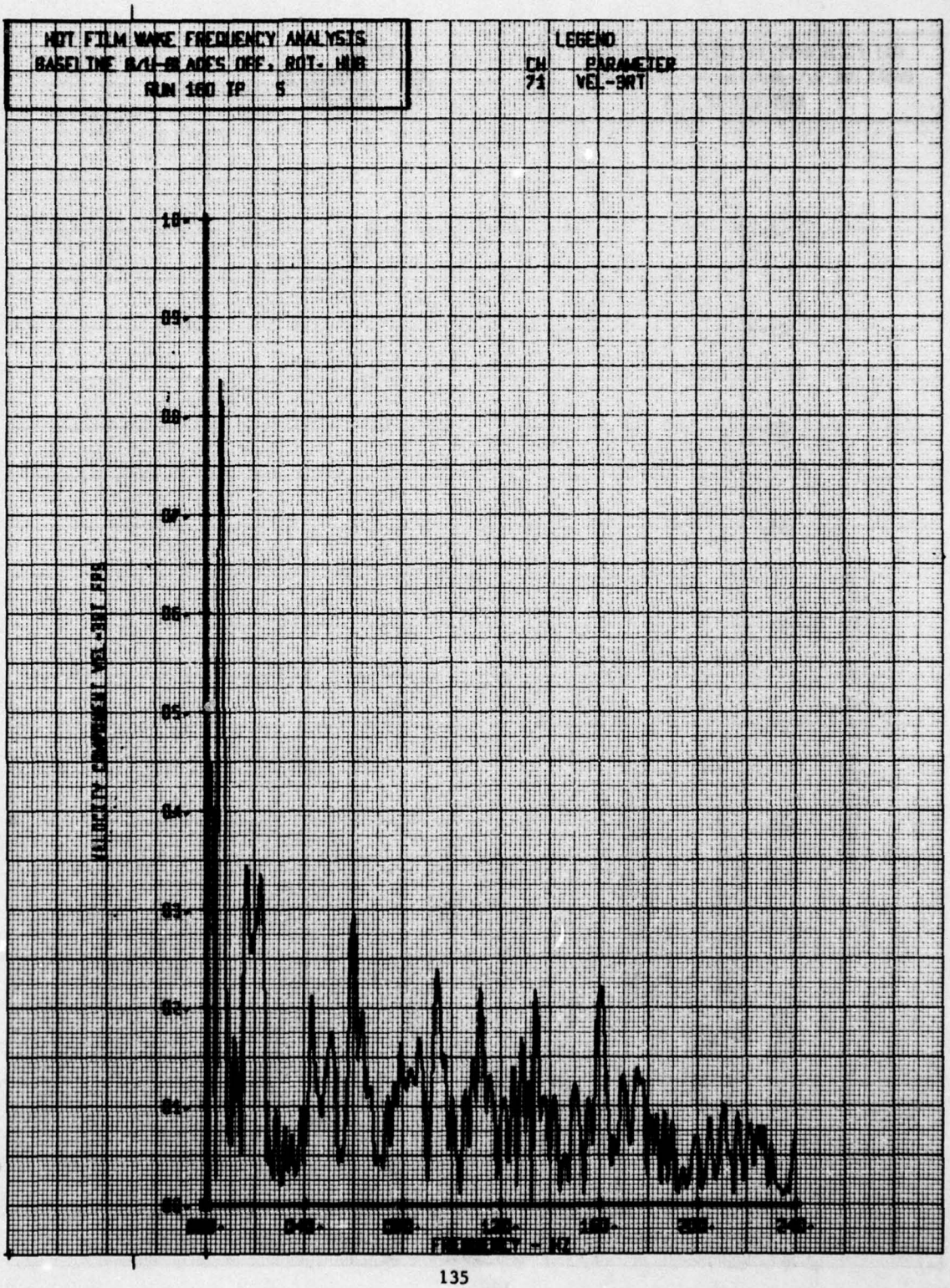
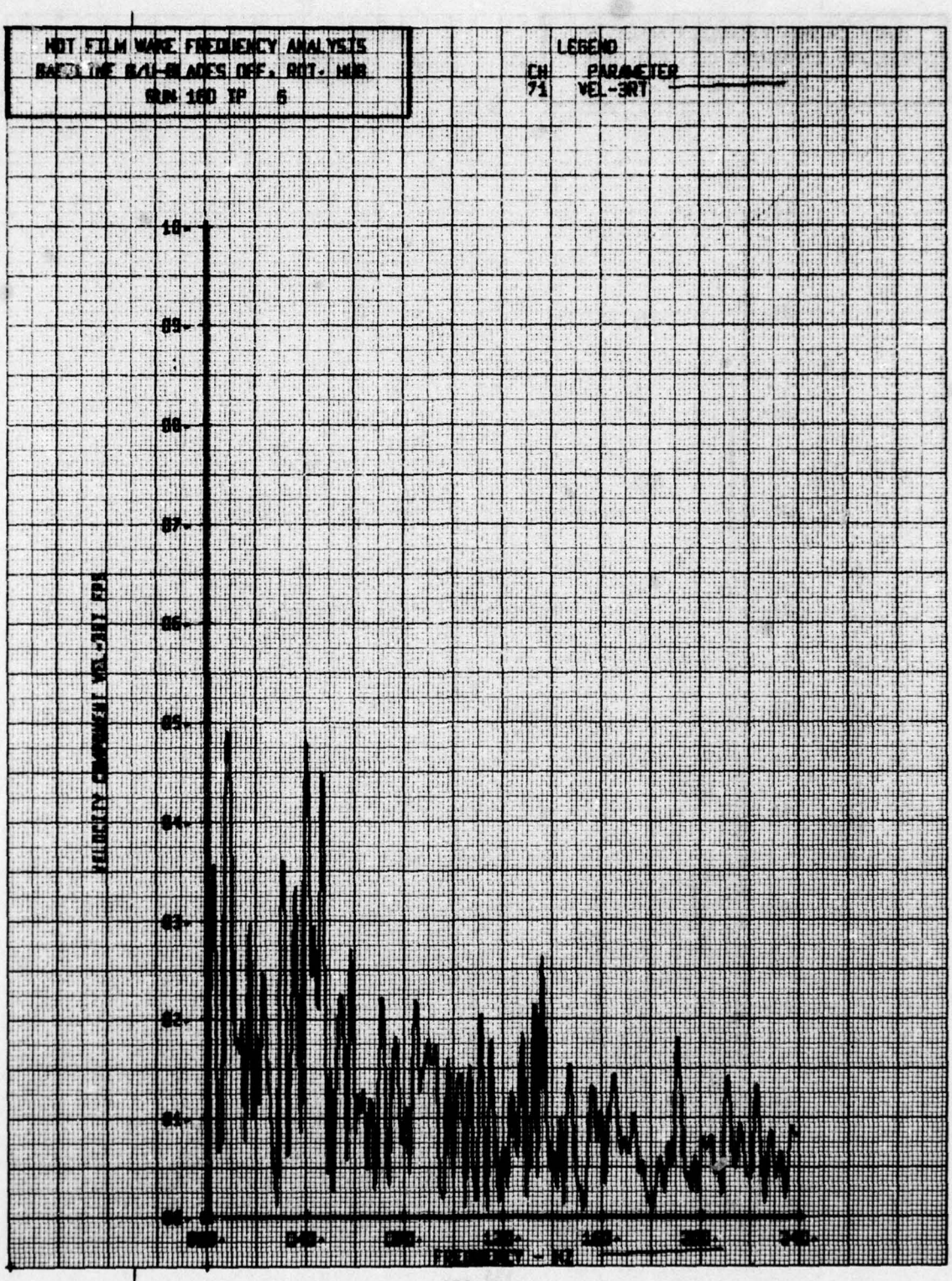
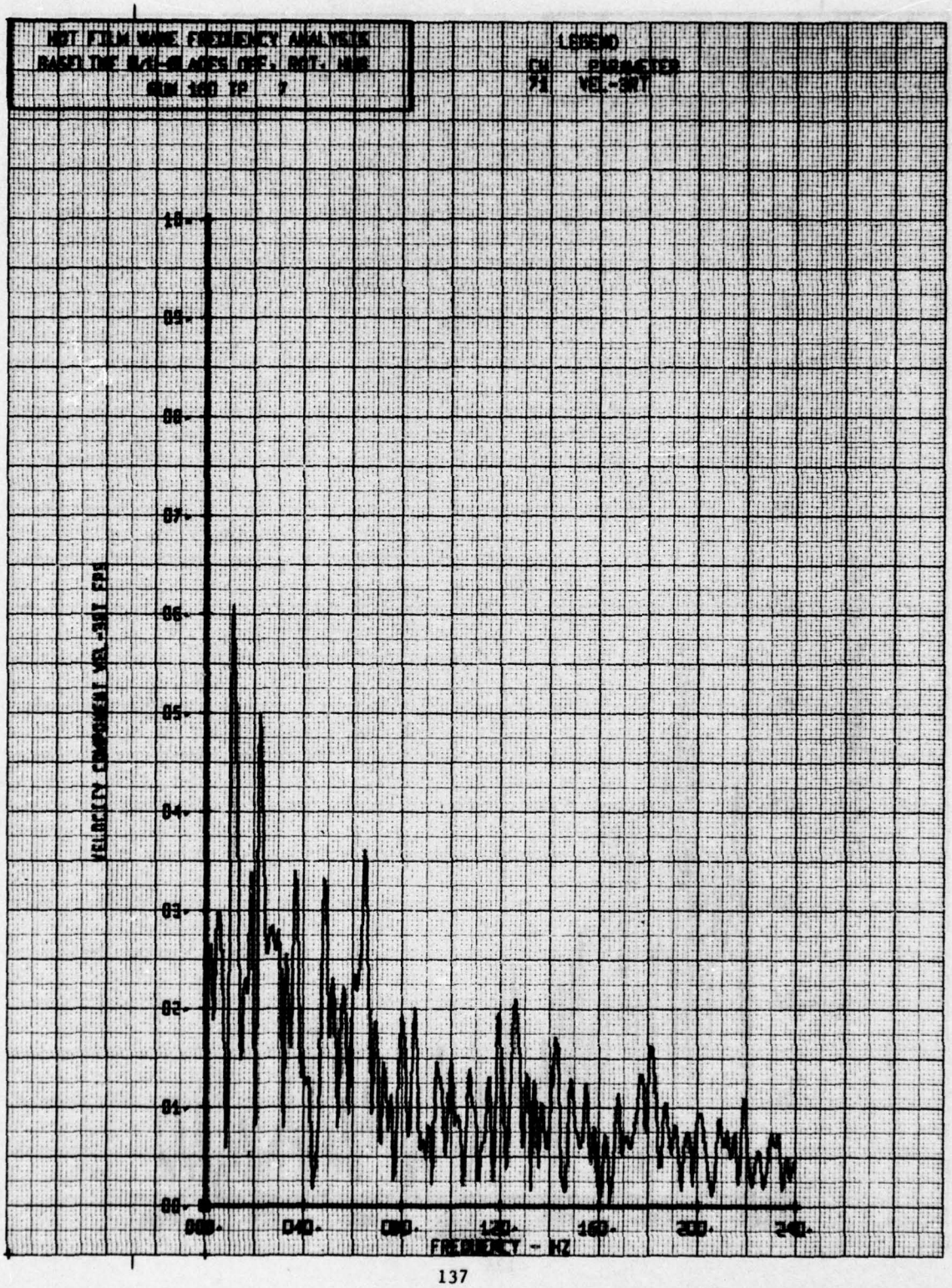
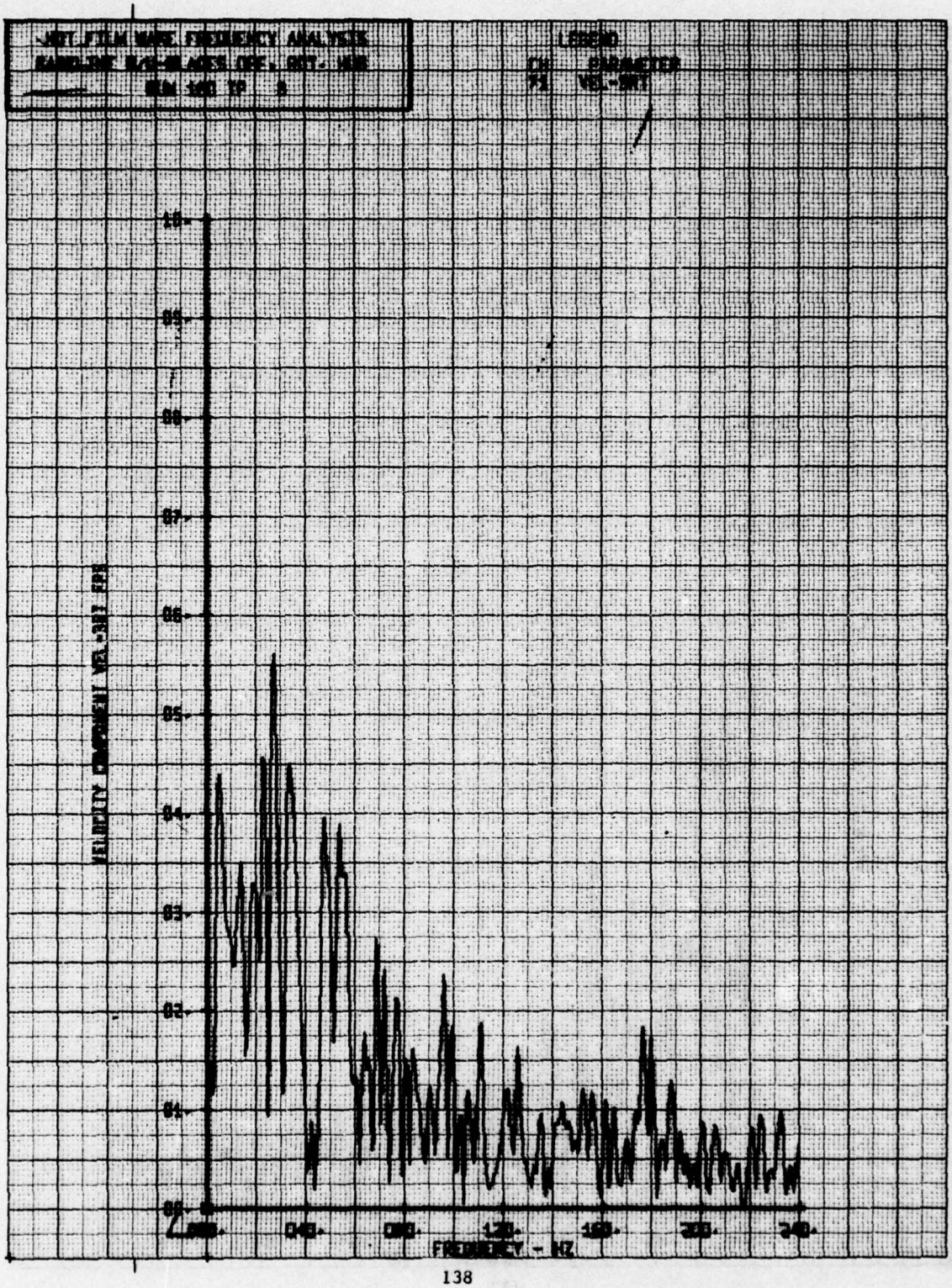
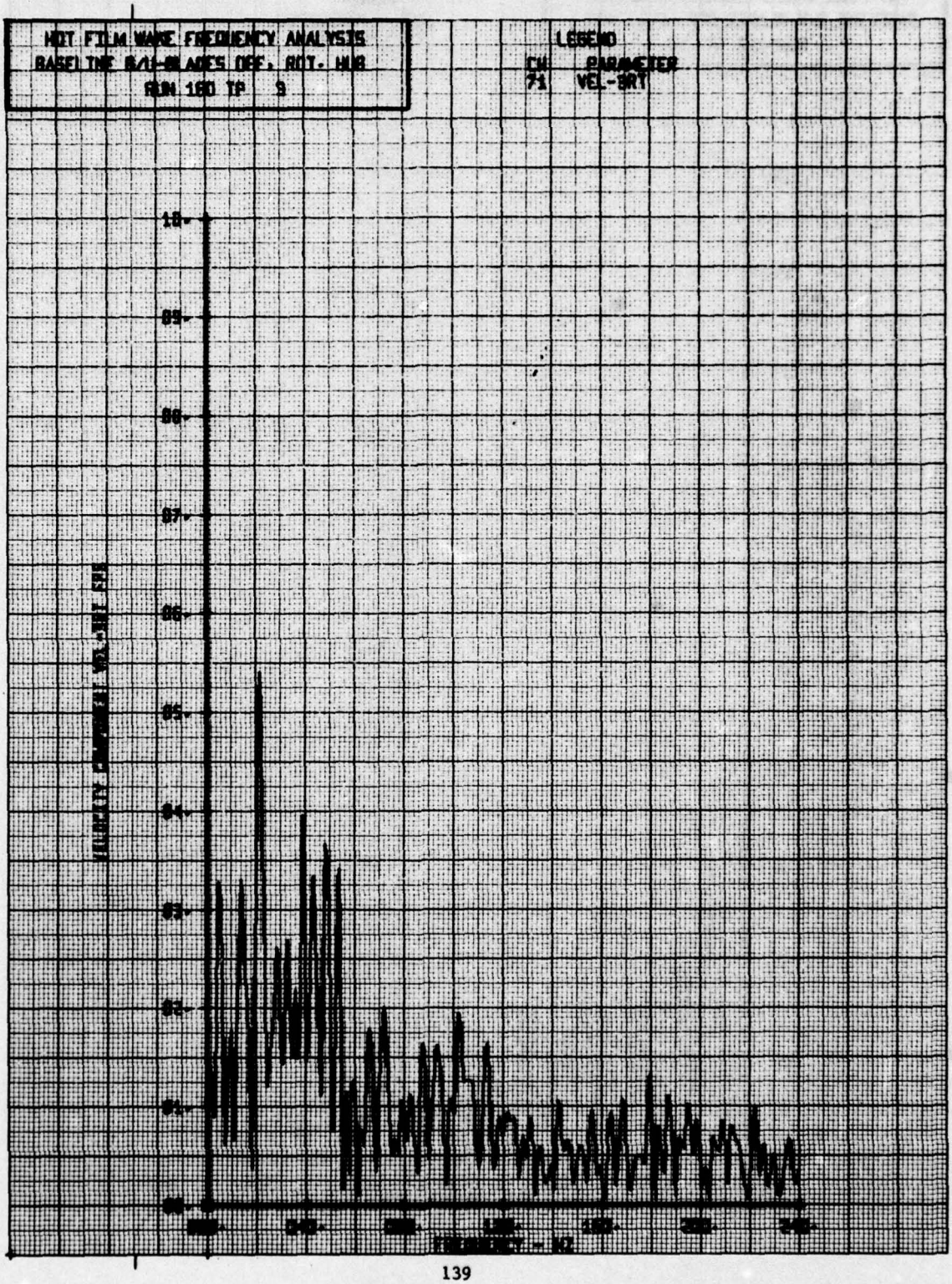
000-
040-
080-
120-
160-
200-
240-
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE 8/1-8R ADES OFF, ROT. HUB
RUN 160 TP 5
LEGEND
CH PARAMETER
71 VEL-3RT
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0.0
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE W/I-BLADES OFF, ROT. HUB
RUN 180 TP 6
LEGEND
CH PARAMETER
71 VEL-3RT
10
89
88
87
86
85
84
83
82
81
80


HOT FILM WAKE FREQUENCY ANALYSIS
RADIUS
RUN 160 TP 7
LEGEND
CH PARAMETER
71 VEL.-3RT
VELOCITY COMPONENT VEL-3RT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
CH CHARACTER
P2 VEL.-SRT
VELOCITY COMPONENT VEL.-SRT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE 8/11-BLADES OFF, ROT. HUB
RUN 160 TP 9
LEGEND
CH PARAMETER
71 VEL-BRT
18
89
88
87
86
85
84
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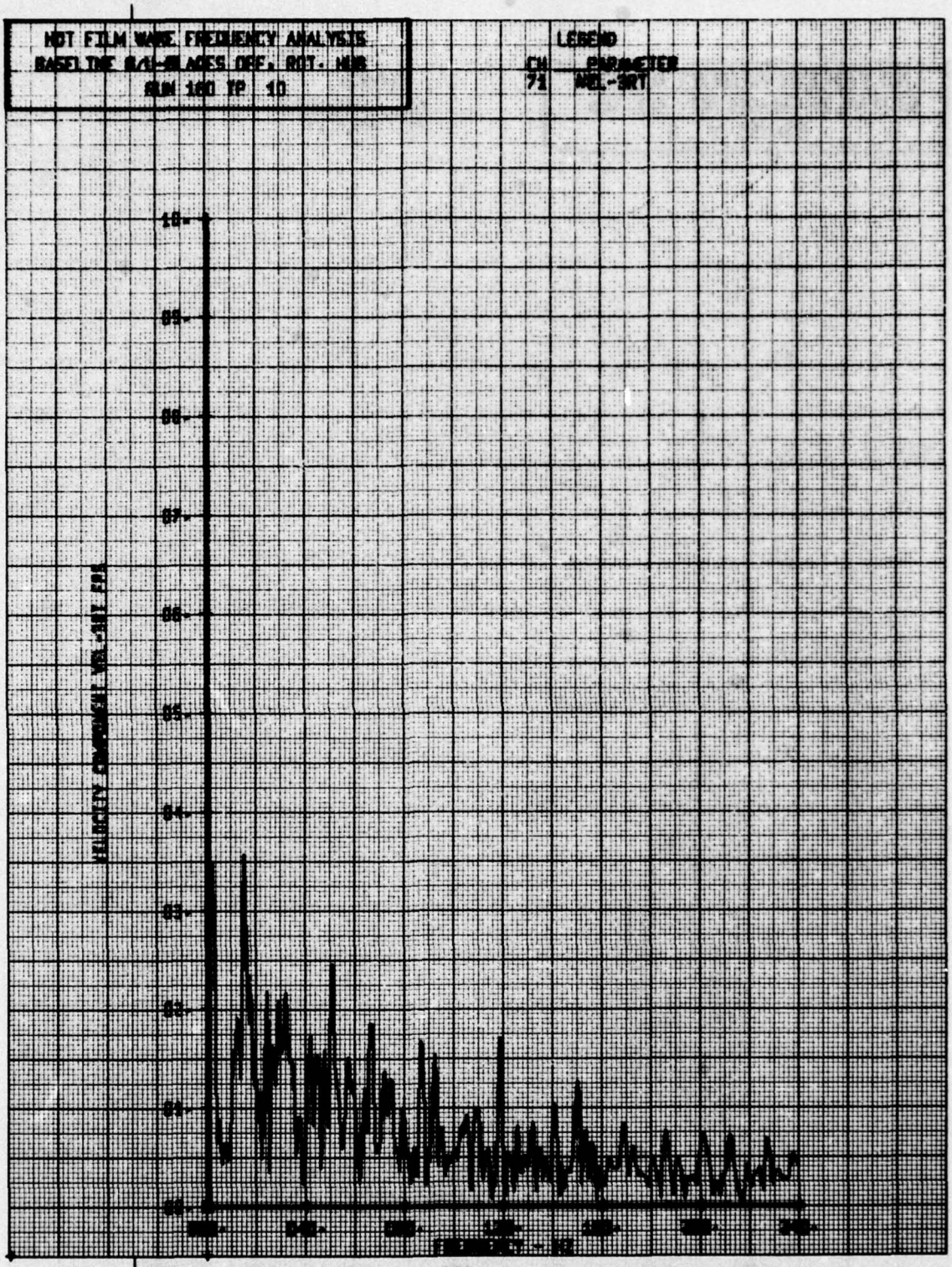
82
81
80


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE W/1-BLADES OFF, ROT. HUB
RUN 180 TP 10
LEGEND
CH PARAMETER
71 WEL-SRT
10
09
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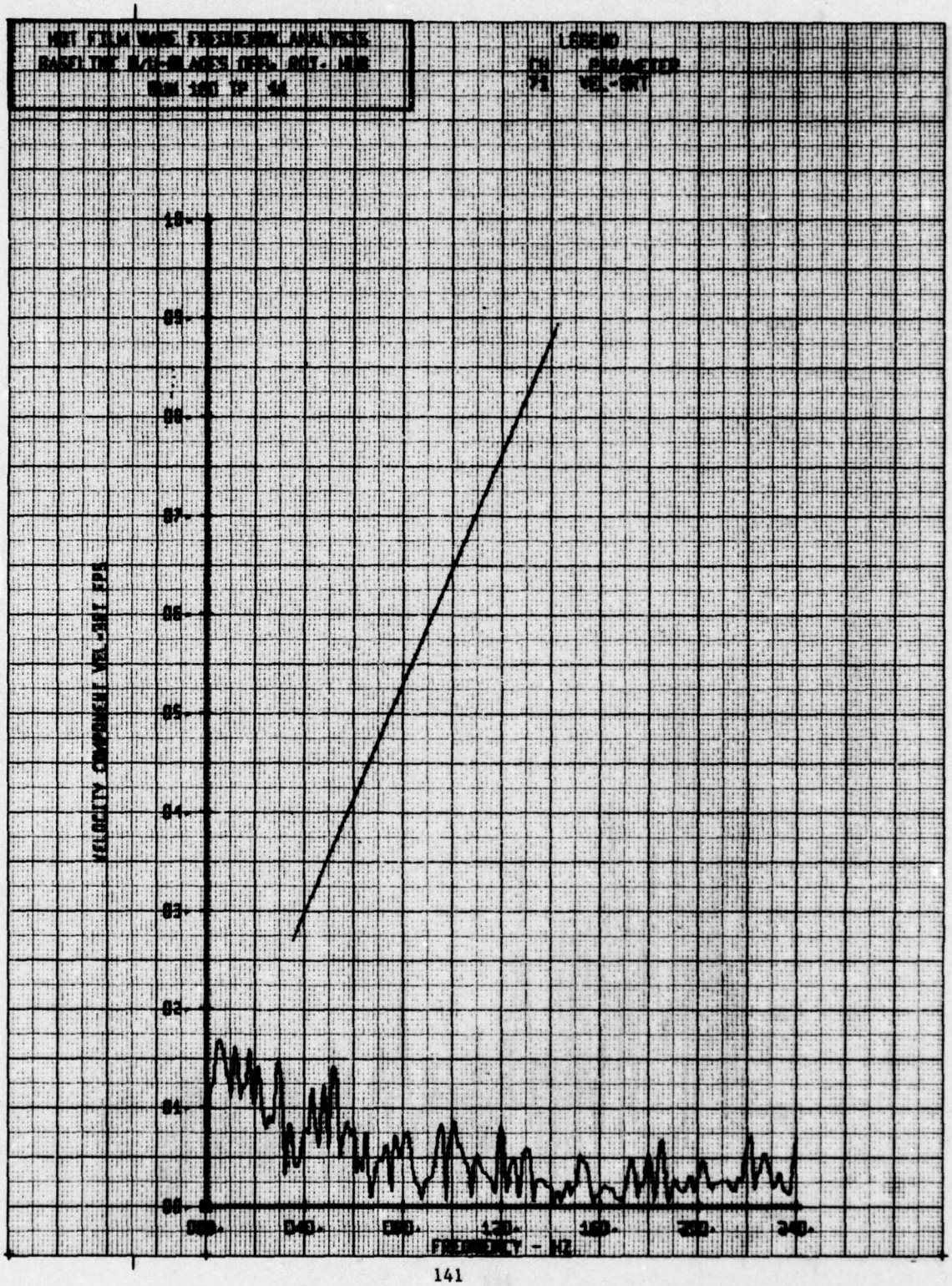
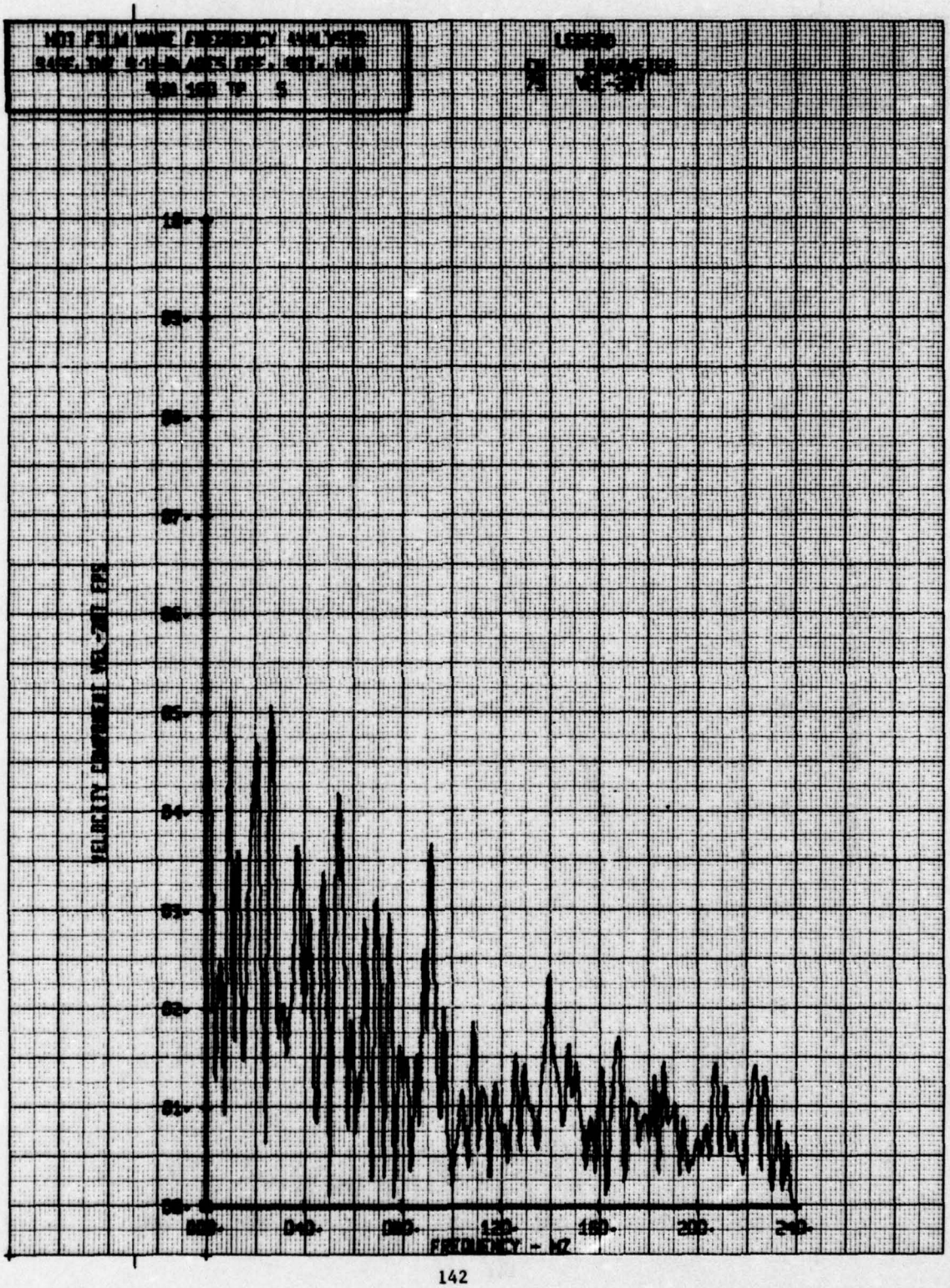
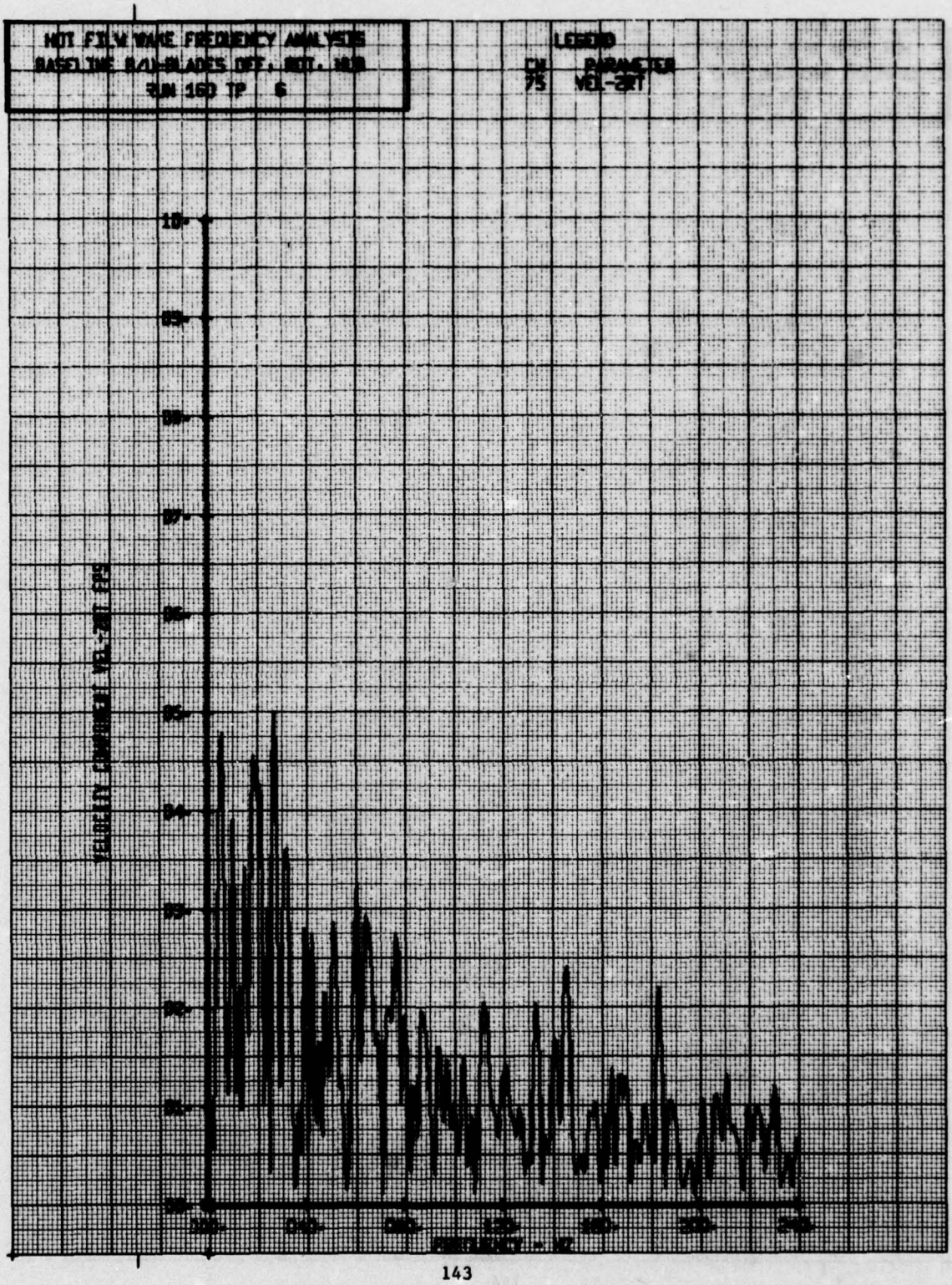
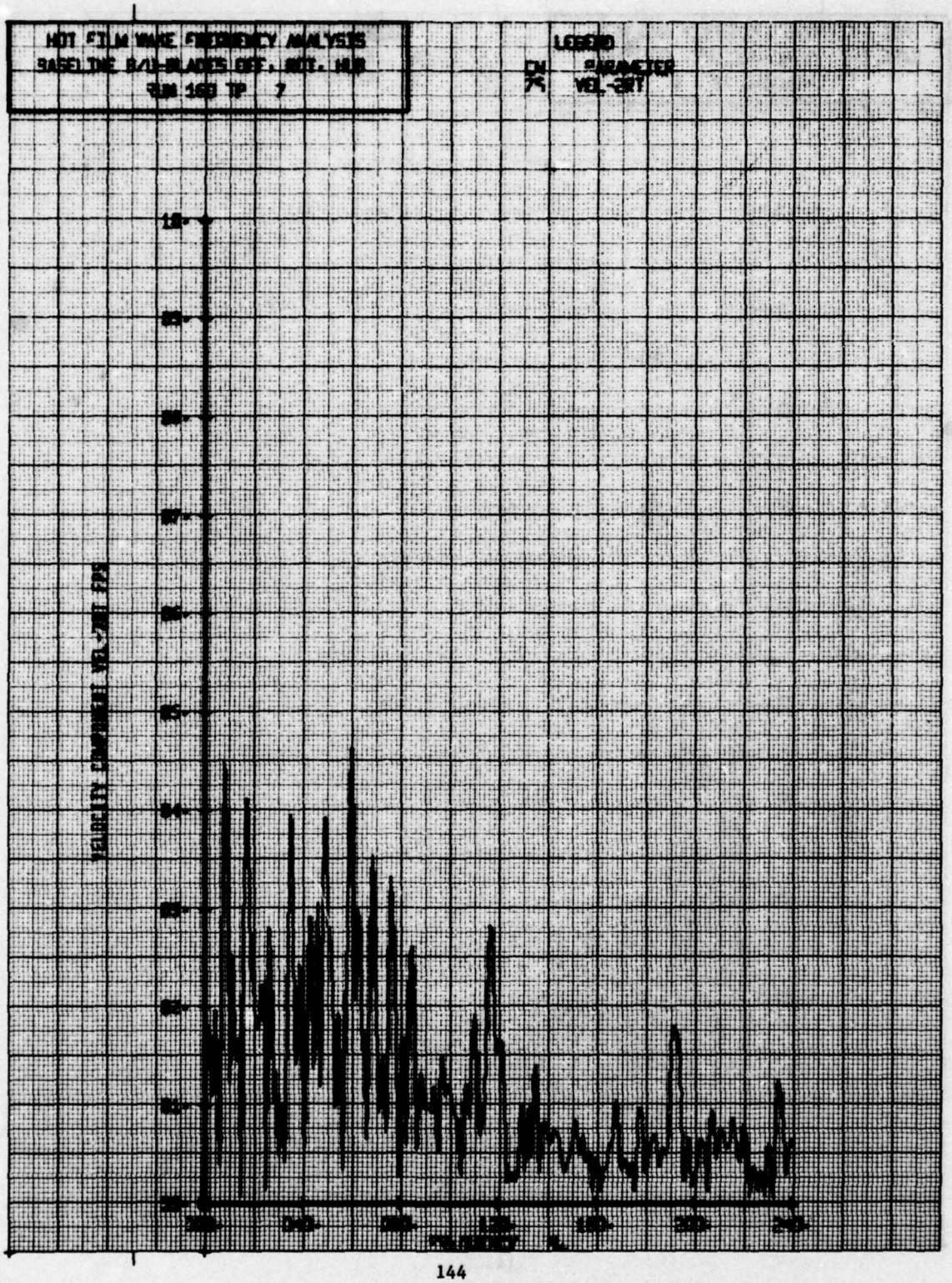
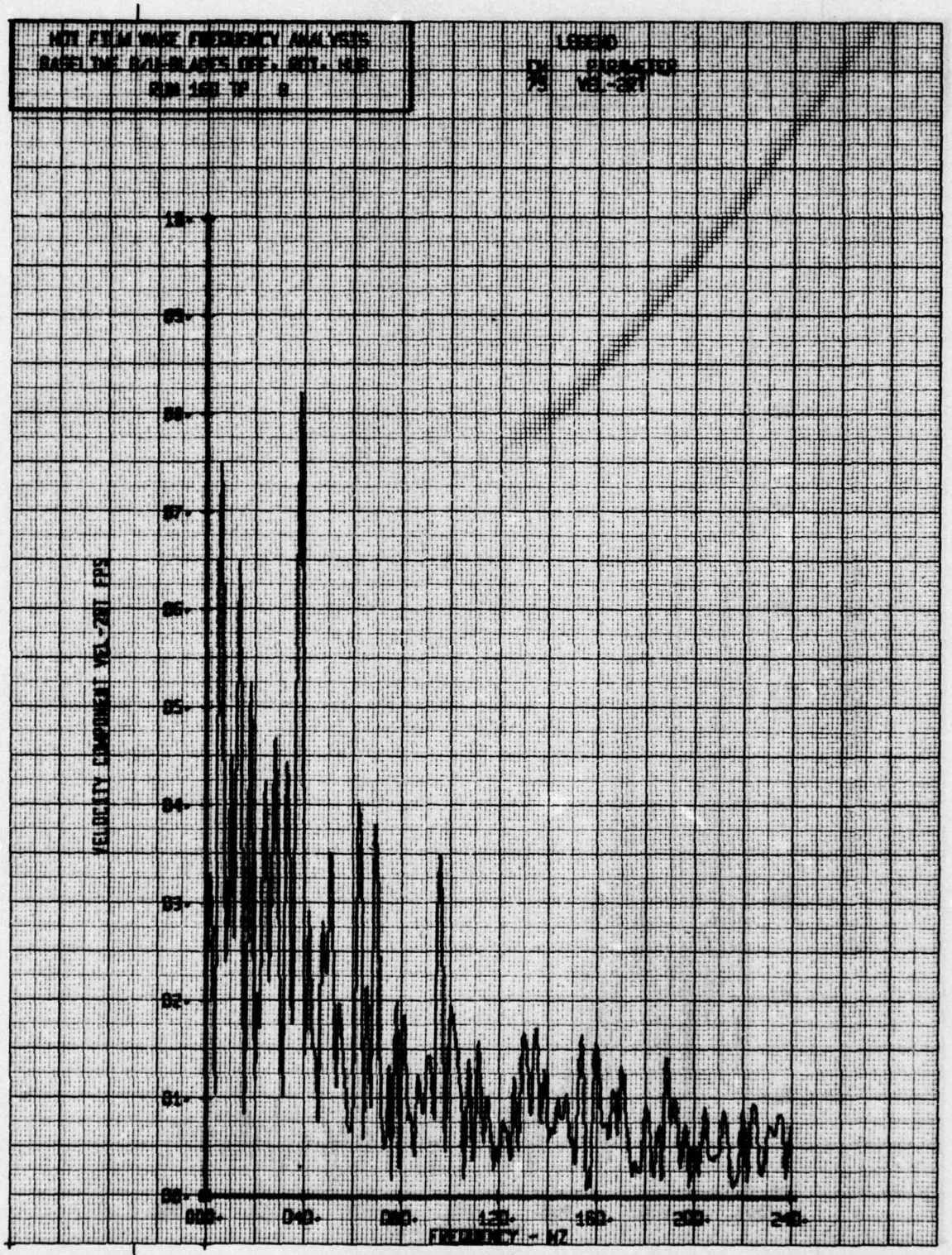
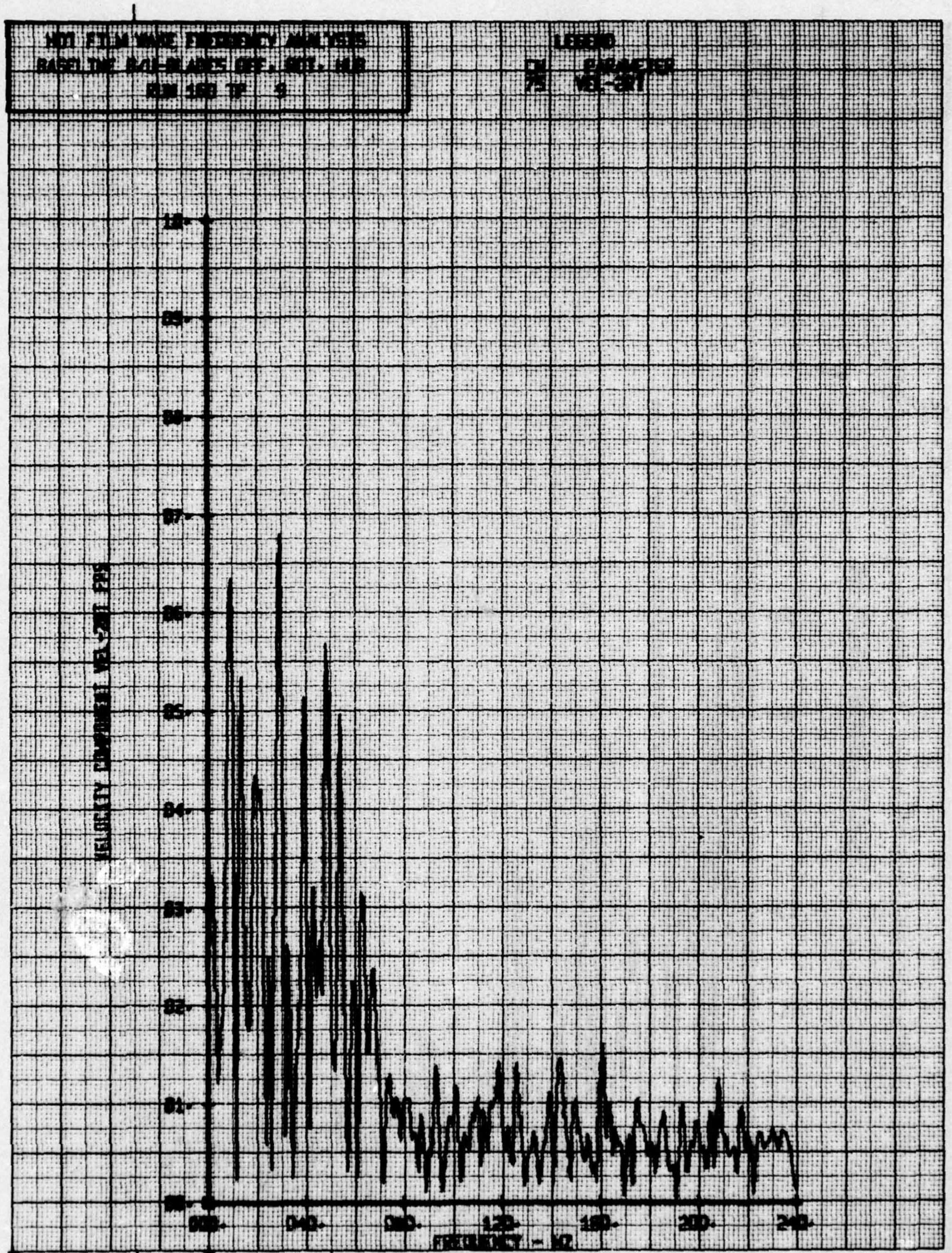

LEGEND
CH CHARACTER
P1 VEL-SRT
VELOCITY COMPONENT VEL-SRT FPS
FREQUENCY - HZ

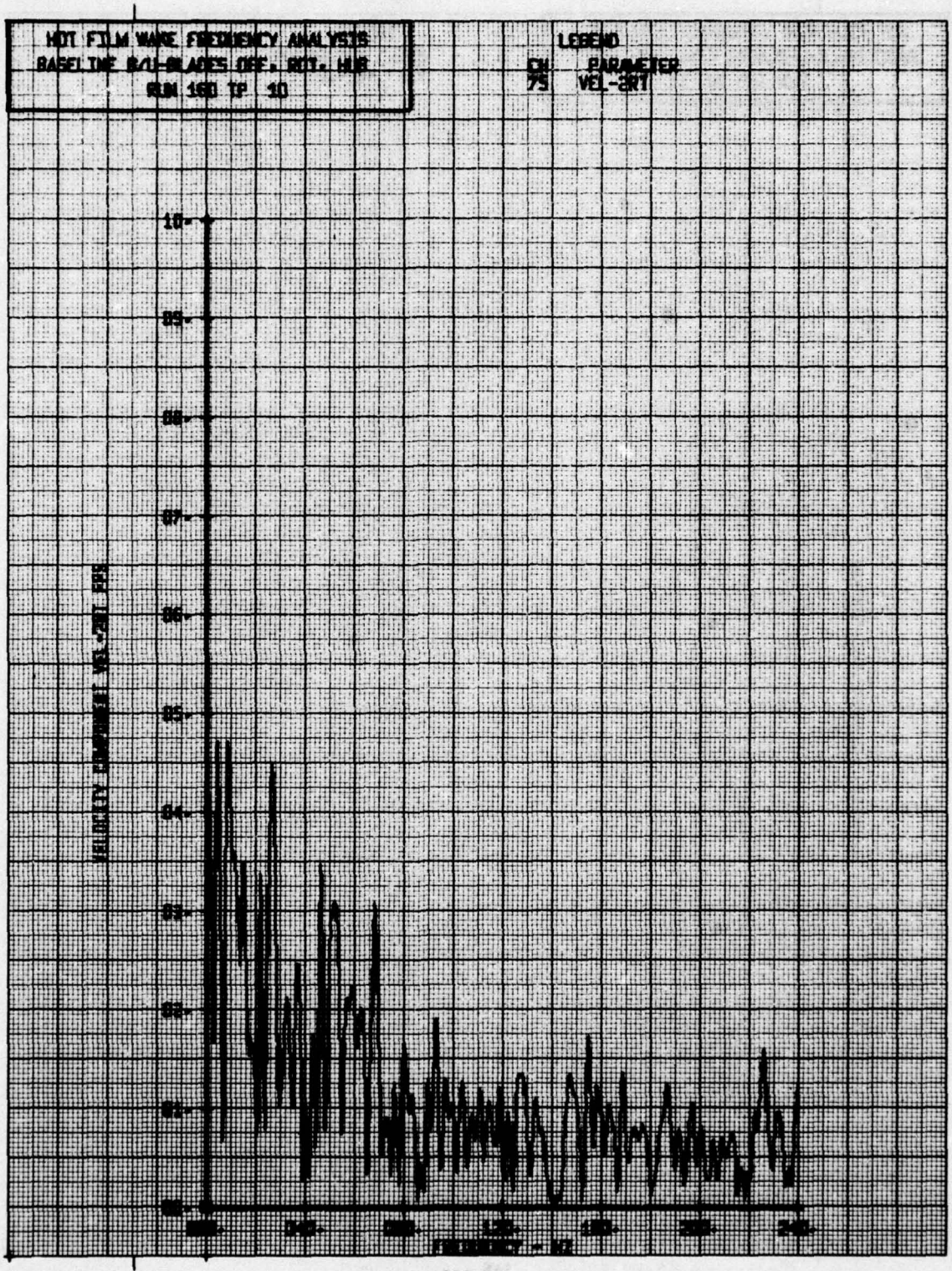

FREQUENCY - KZ

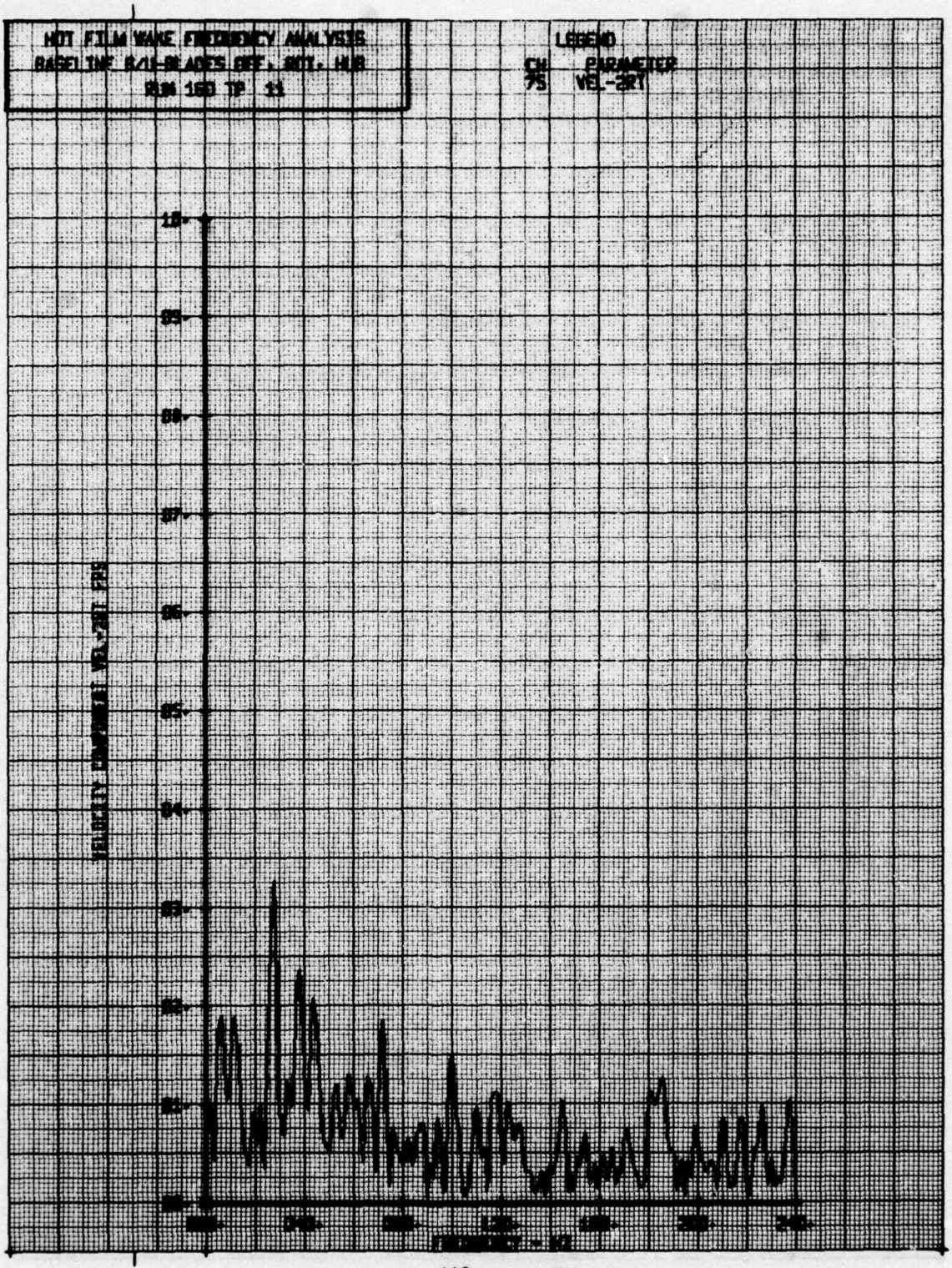

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/C-BLADES DEF. REF. HUB
RUN 160 TP 6
LEGEND
CH PARAMETER
75 VEL-2RT
10
85
80
75
70
65
60
55
50
VELOCITY COMPONENT VEL-2RT FPS

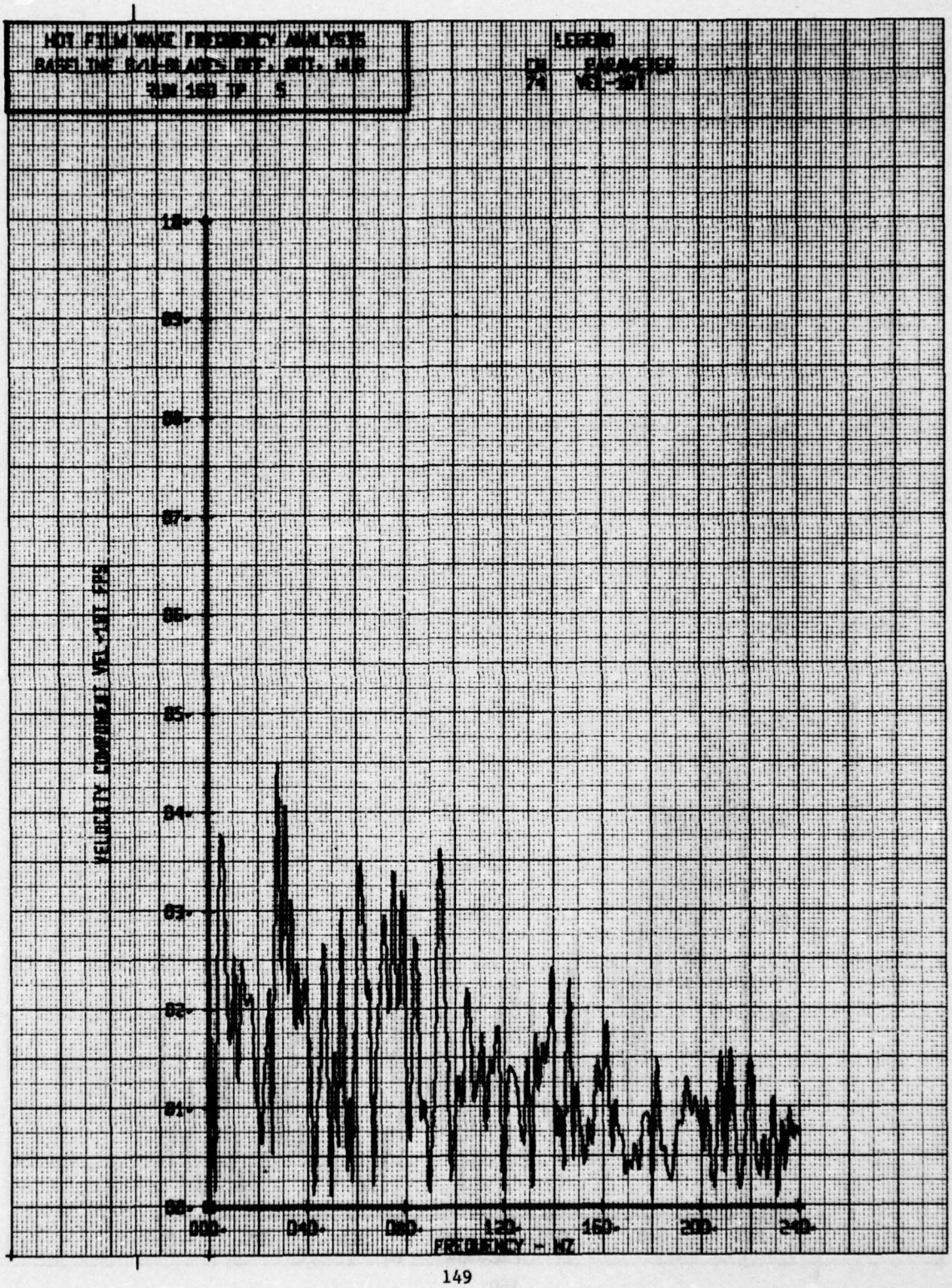

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/L-BLADES OFF, BOT. HUB
RUN 163 TP 7
LEGEND
CH PARAMETER
75 VEL-2BT
FOURIER COMPONENT VEL-2BT FPS

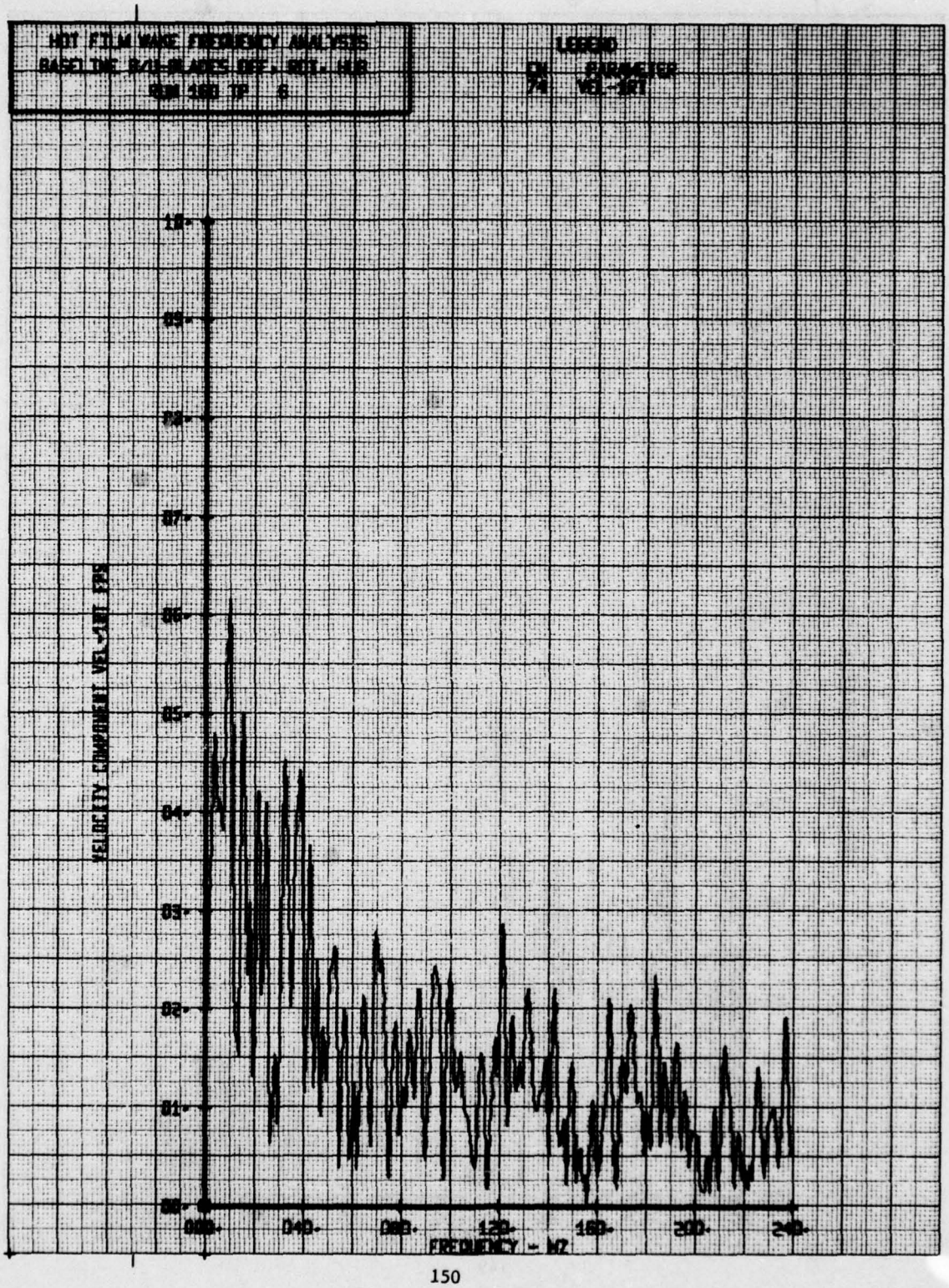

LEGEND
VEL-2RT
VELOCITY COMPONENT VEL-2RT FPS
FREQUENCY - HZ

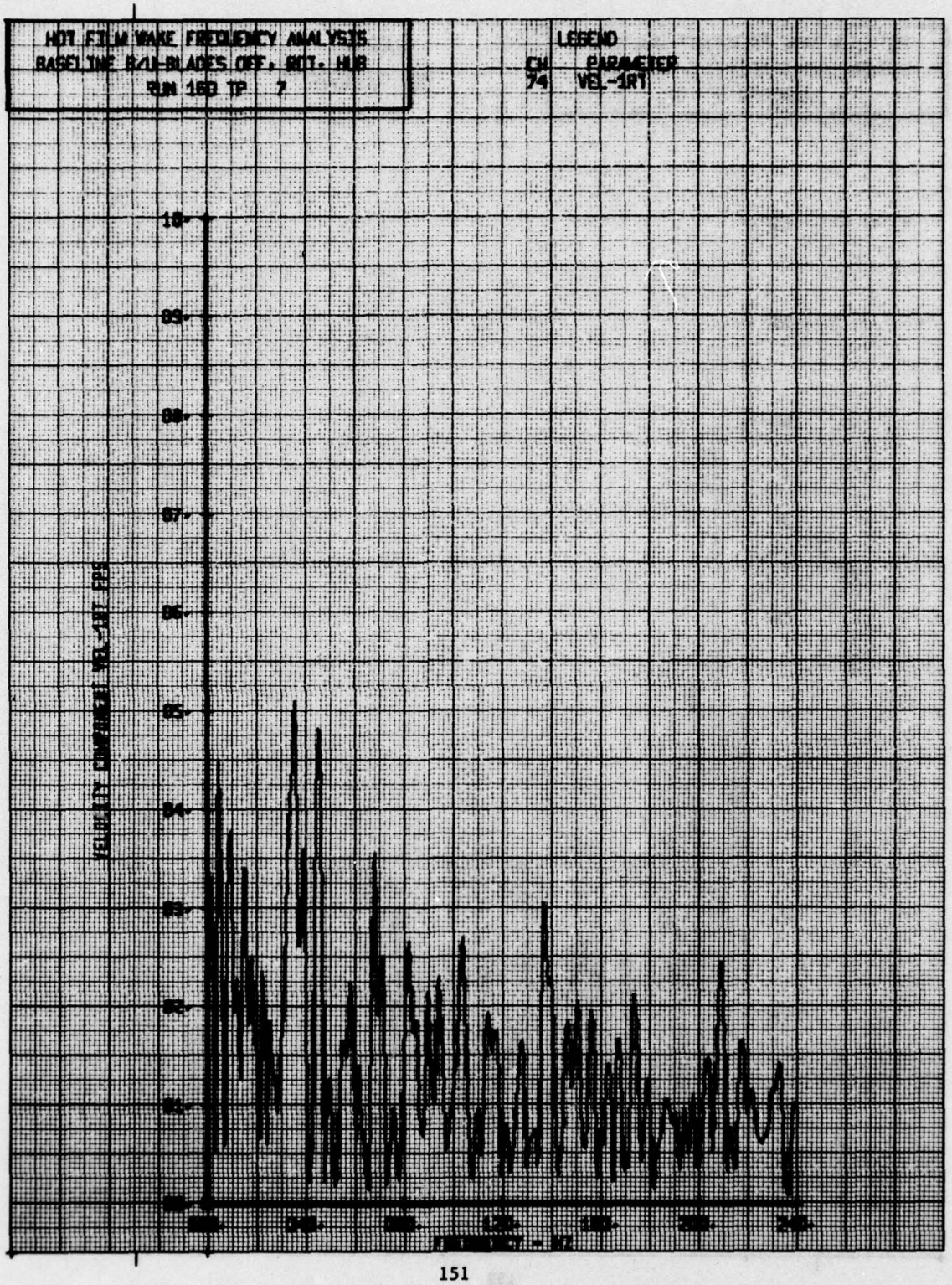

LEGEND
PARAMETER
000
040
080
120
160
200
240
FREQUENCY - HZ

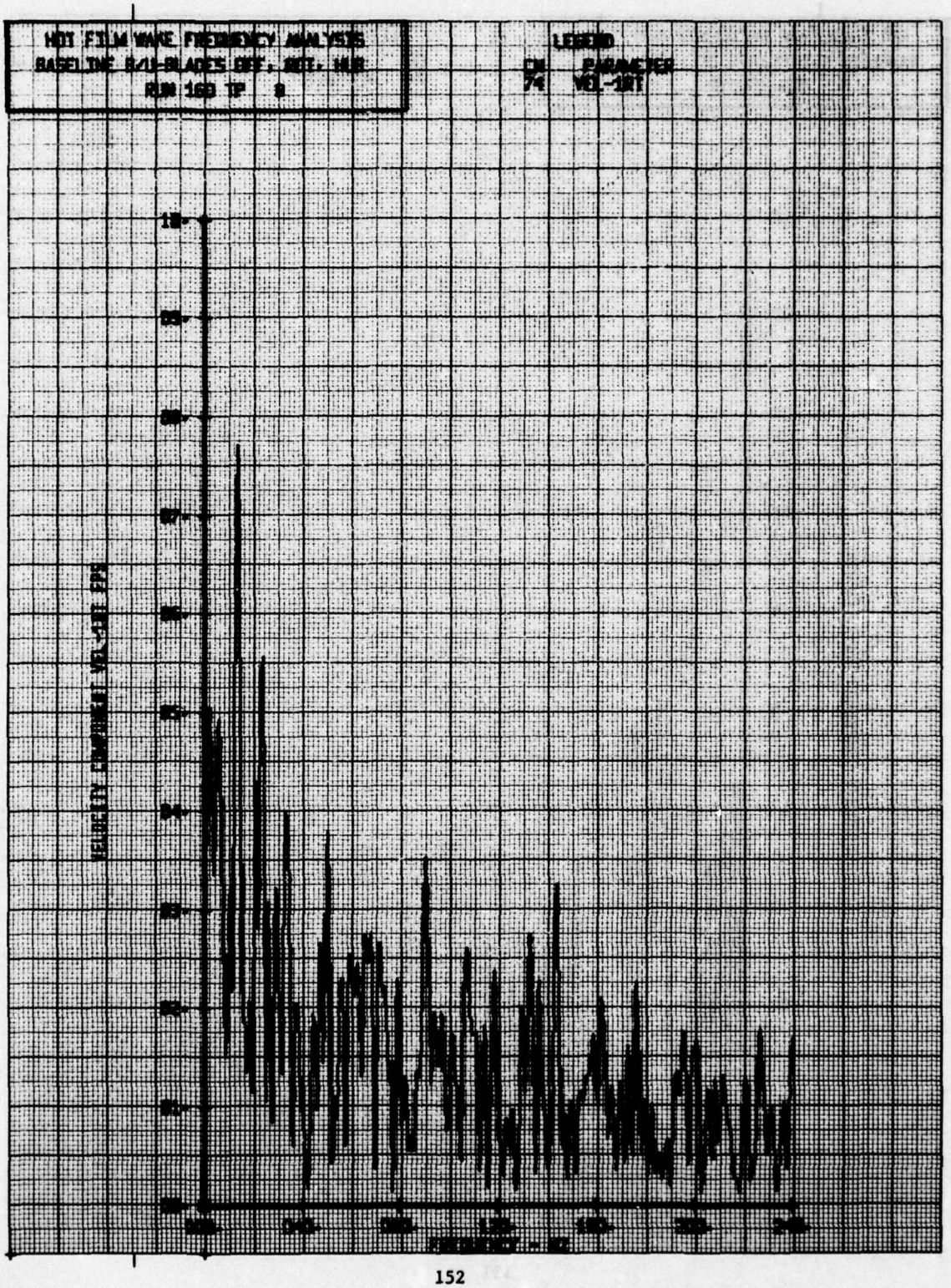

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 10
LEGEND
CH PARAMETER
75 VEL-3RT
10
09
08
07
06
05
04
03
02
01
00
VELOCITY AMPLITUDE VEL-3RT FFT
00
20
40
60
80
100
120
140
160
FREQUENCY - HZ

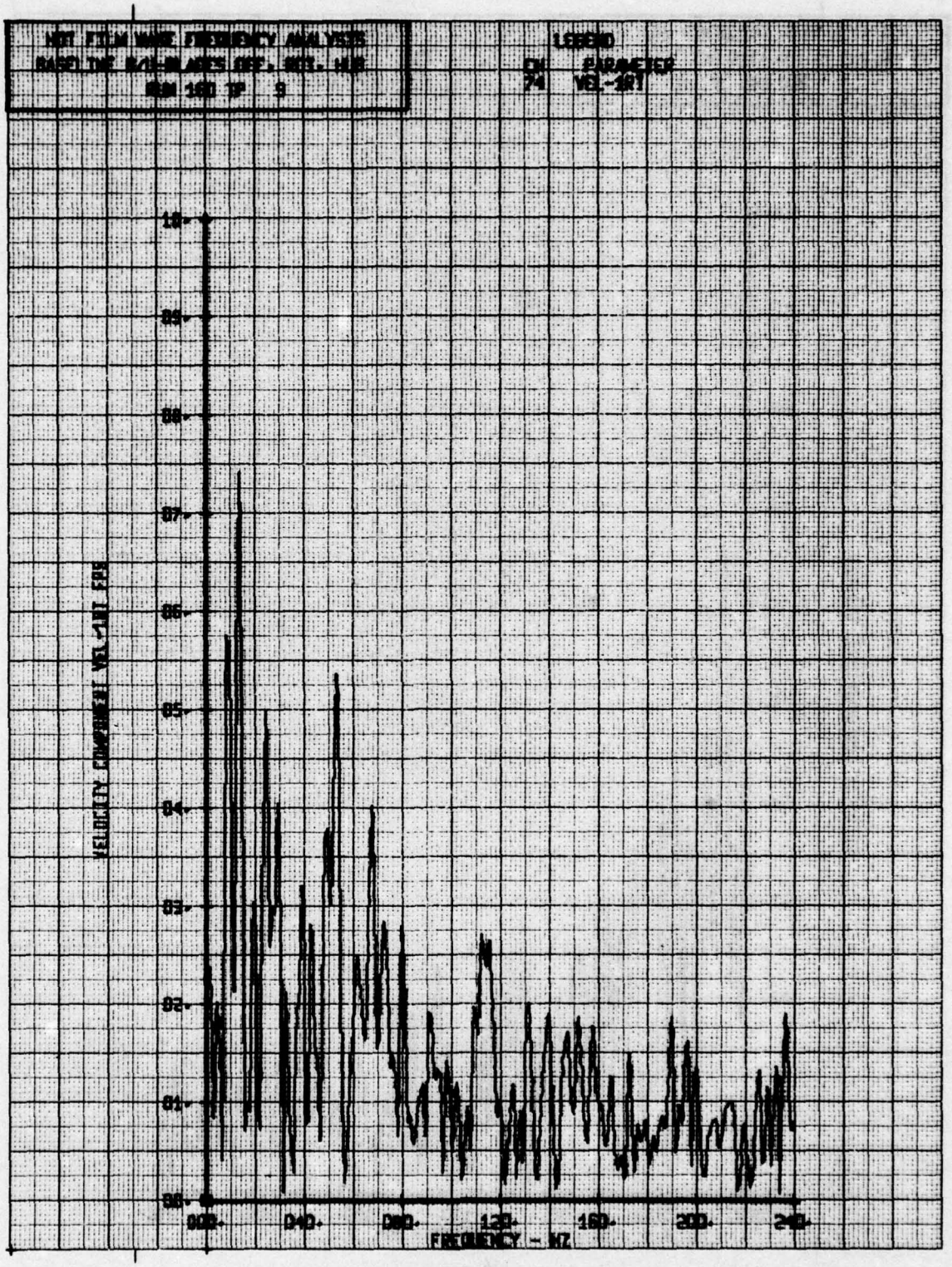

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE 8/15-BLADES DEF. HOT. HUB
RUN 160 TP 11
LEGEND
CH PARAMETER
75 VEL-3RT
18
85
88
87
86
85
84
83
82
81
80
FREQUENCY (PER REVOLUTION)

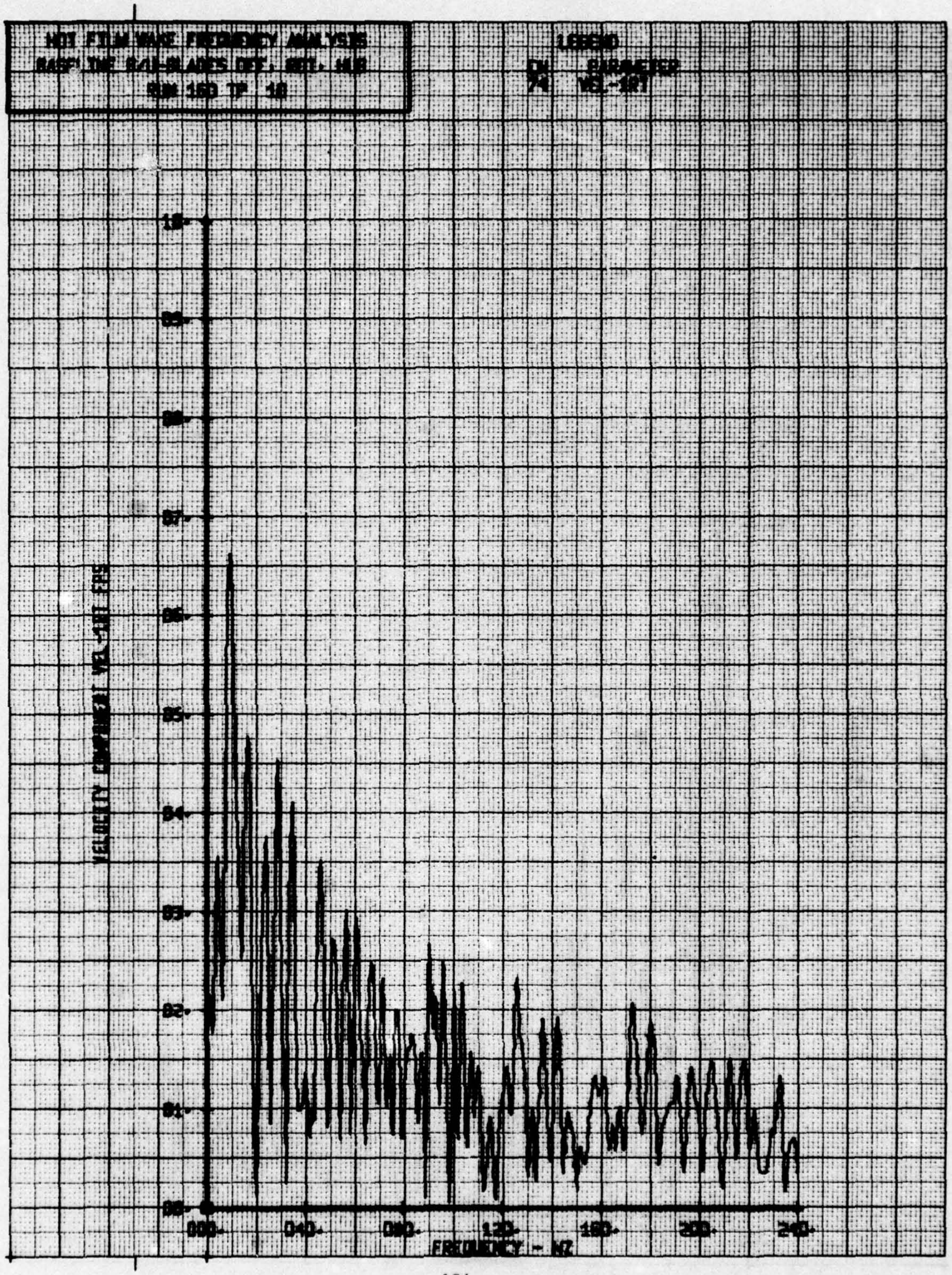

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BLADES OUT, AFT, HUB
RUN 169 TP 5
LEGEND
CH PARAMETER
74 VEL-AFT
VELOCITY COMPONENT VEL-AFT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE R/U-BLADES OFF, HUB
RUN 160 TP 6
LEGEND
CH CHARACTER
74 VEL-JET
VELOCITY COMPONENT VEL-JET FPS
FREQUENCY - HZ

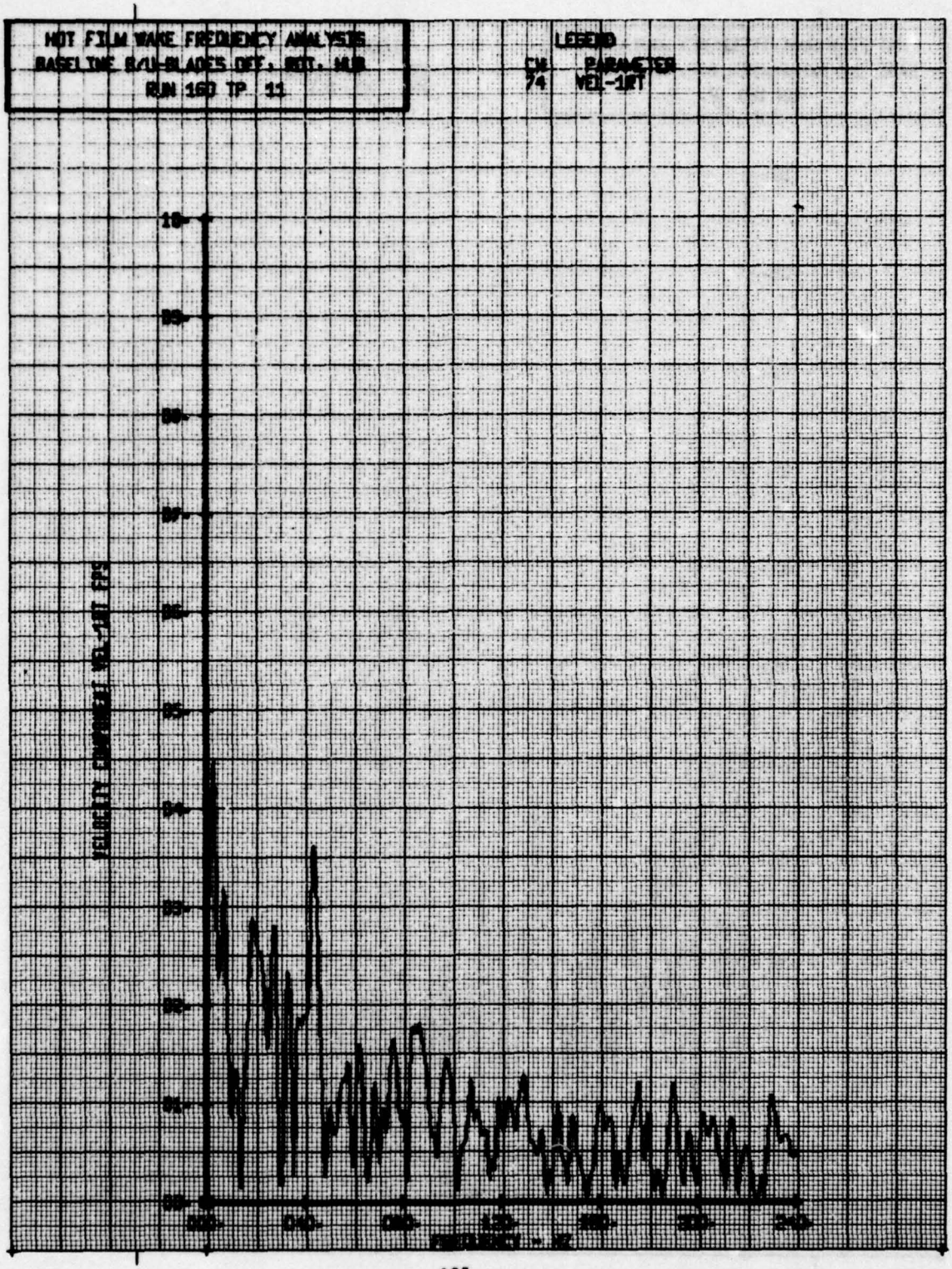

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE R/H-BLADES OFF, HOT. HUB
RUN 160 TP 7
LEGEND
CH PARAMETER
74 VEL-1RT
FREQUENCY SPECTRUM OF VEL-1RT PSD


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE 8/11-BLADES OUT, MID. HUB
RUN 169 TP 8
LEGEND
CH PARAMETER
74 VEL-1BT


LEGEND
CH PARAMETER
24 VEL-1RT
FREQUENCY - HZ



HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
CH PARAMETER
FREQUENCY - HZ
000
040
080
120
160
200
240


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES DEF. RET. HUB
RUN 160 TP 11
LEGEND
CH PARAMETER
74 VEL-1RT
VELOCITY COMPONENT VEL-1RT FPS
10
09
08
07
06
05
04
03
02
01
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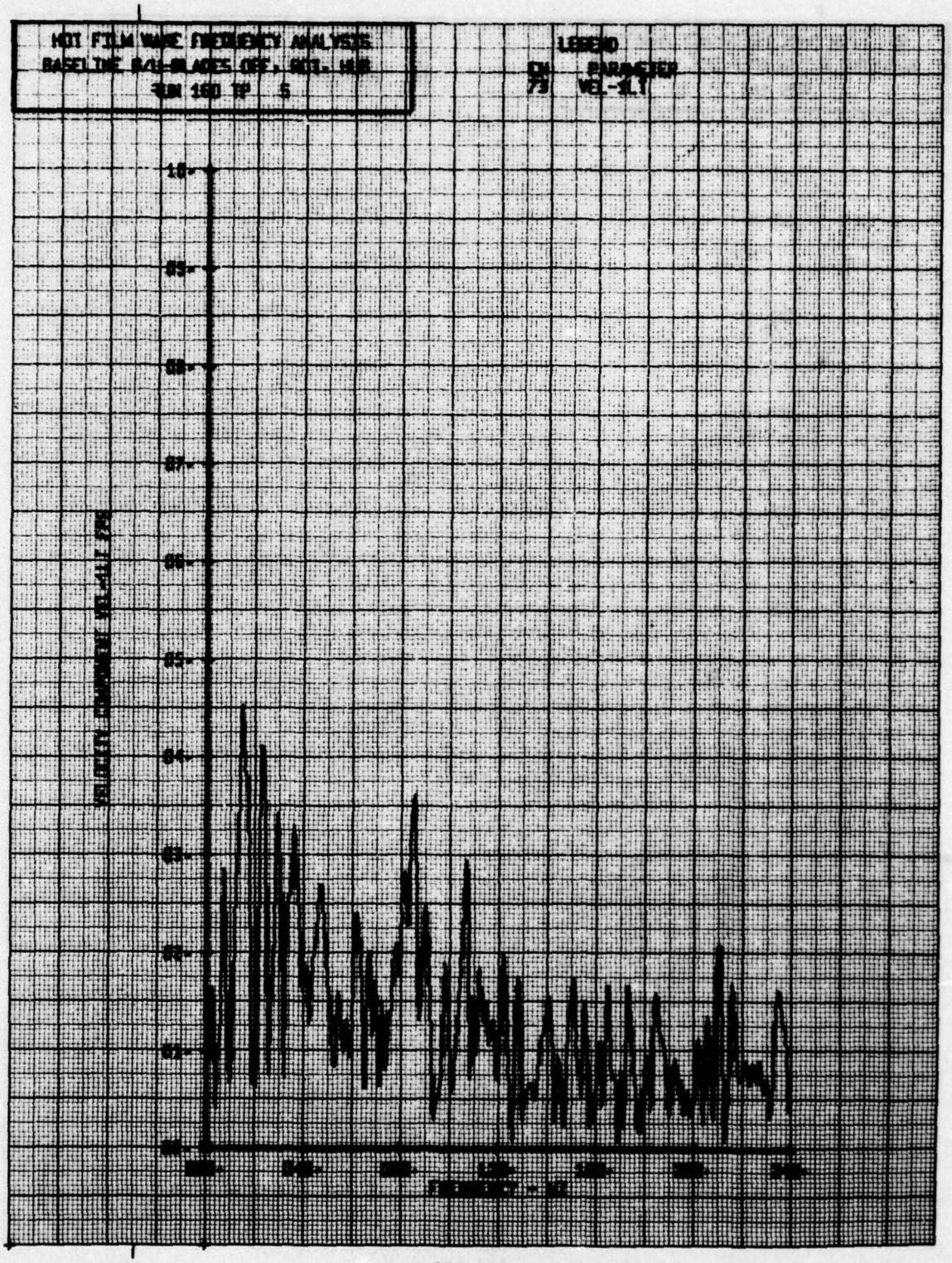
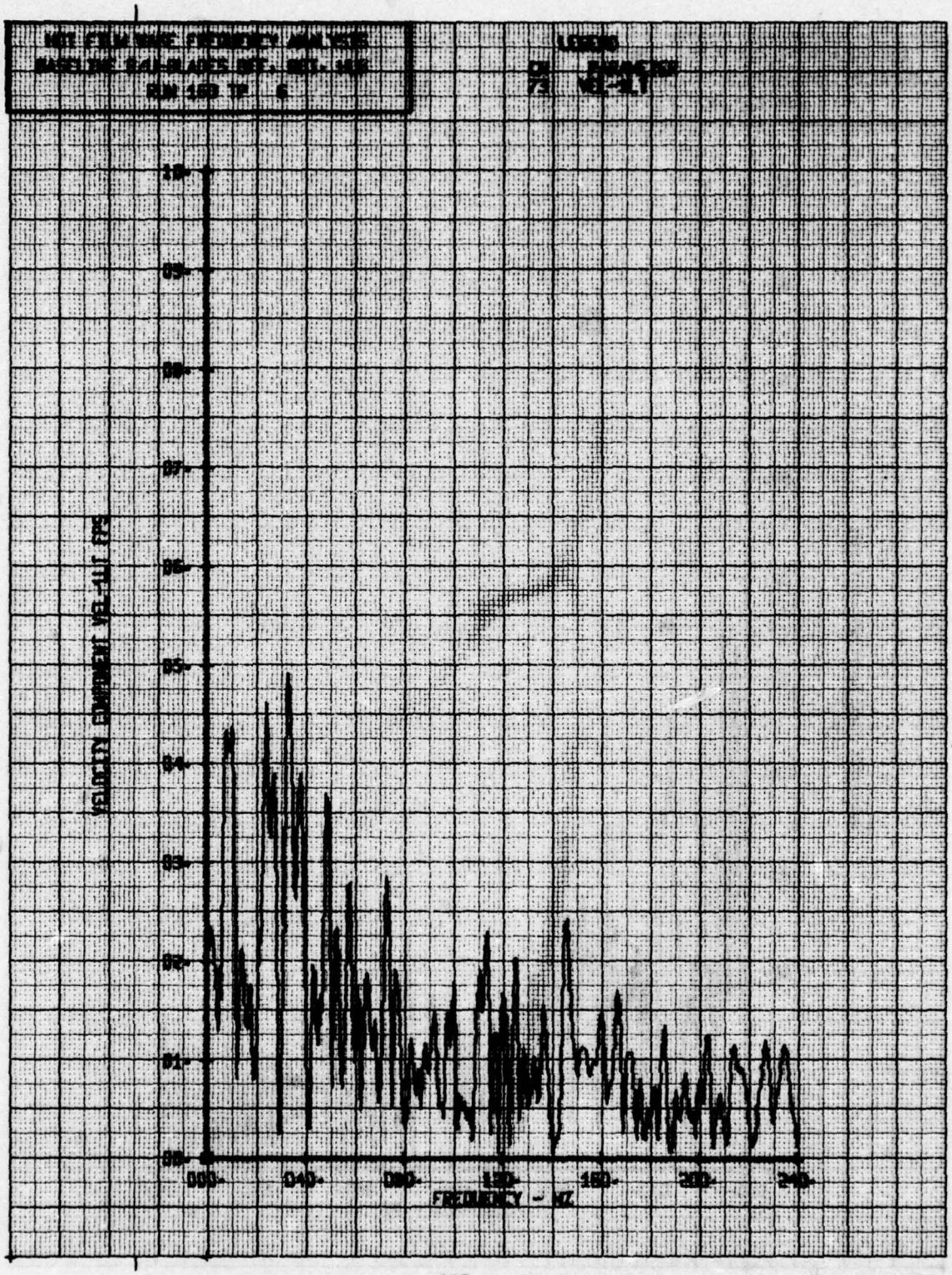
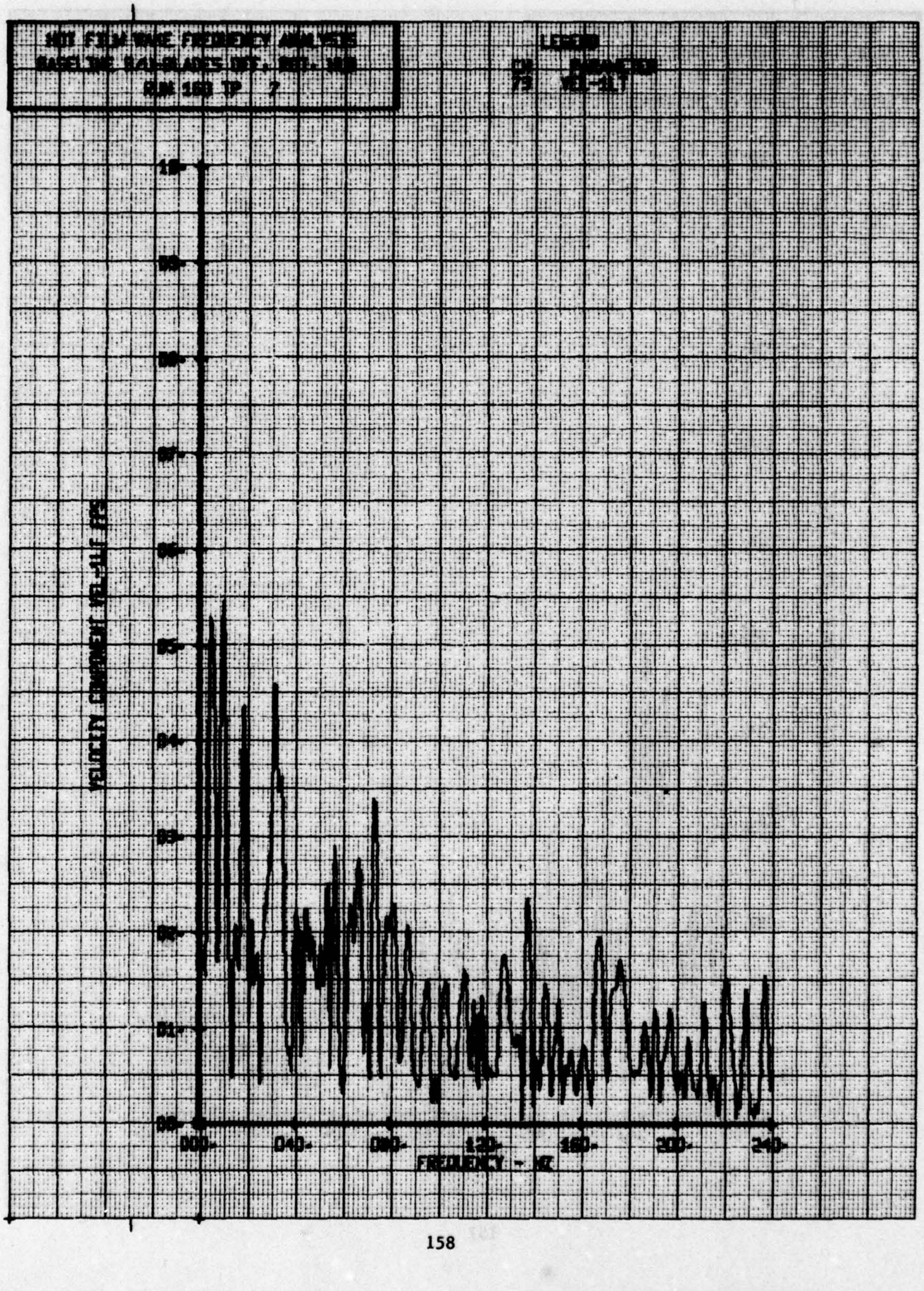
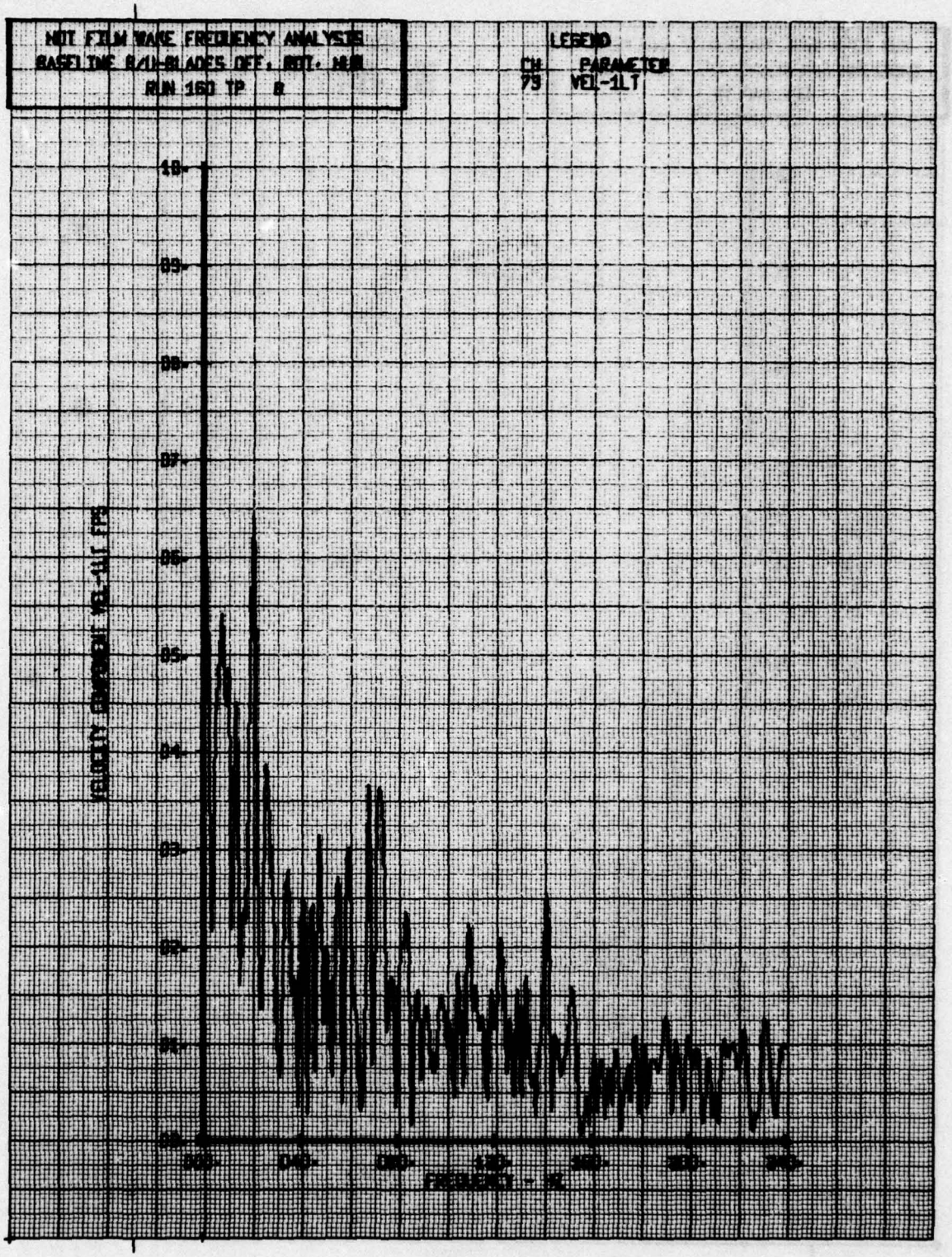
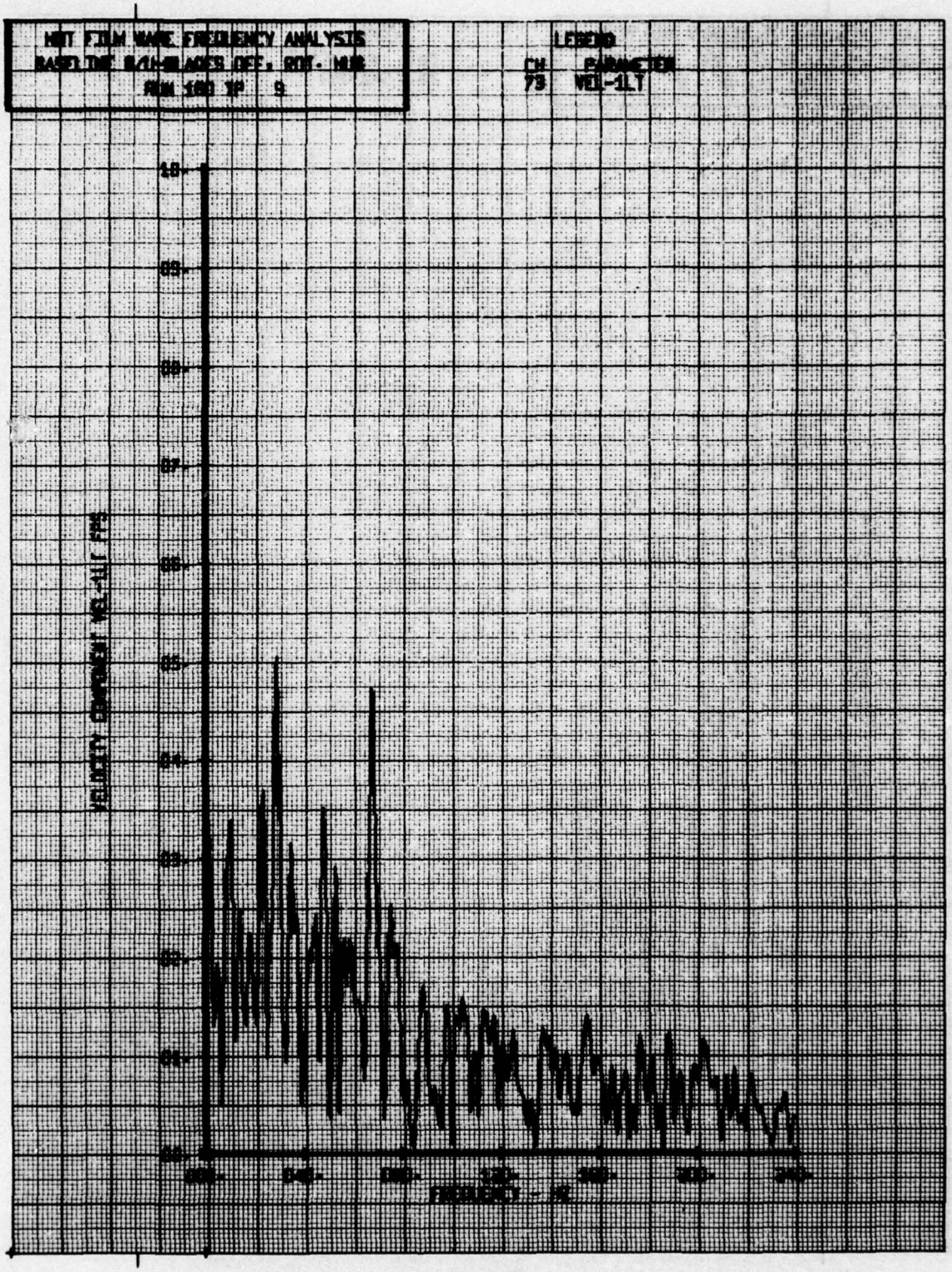
000
040
080
120
160
200
240

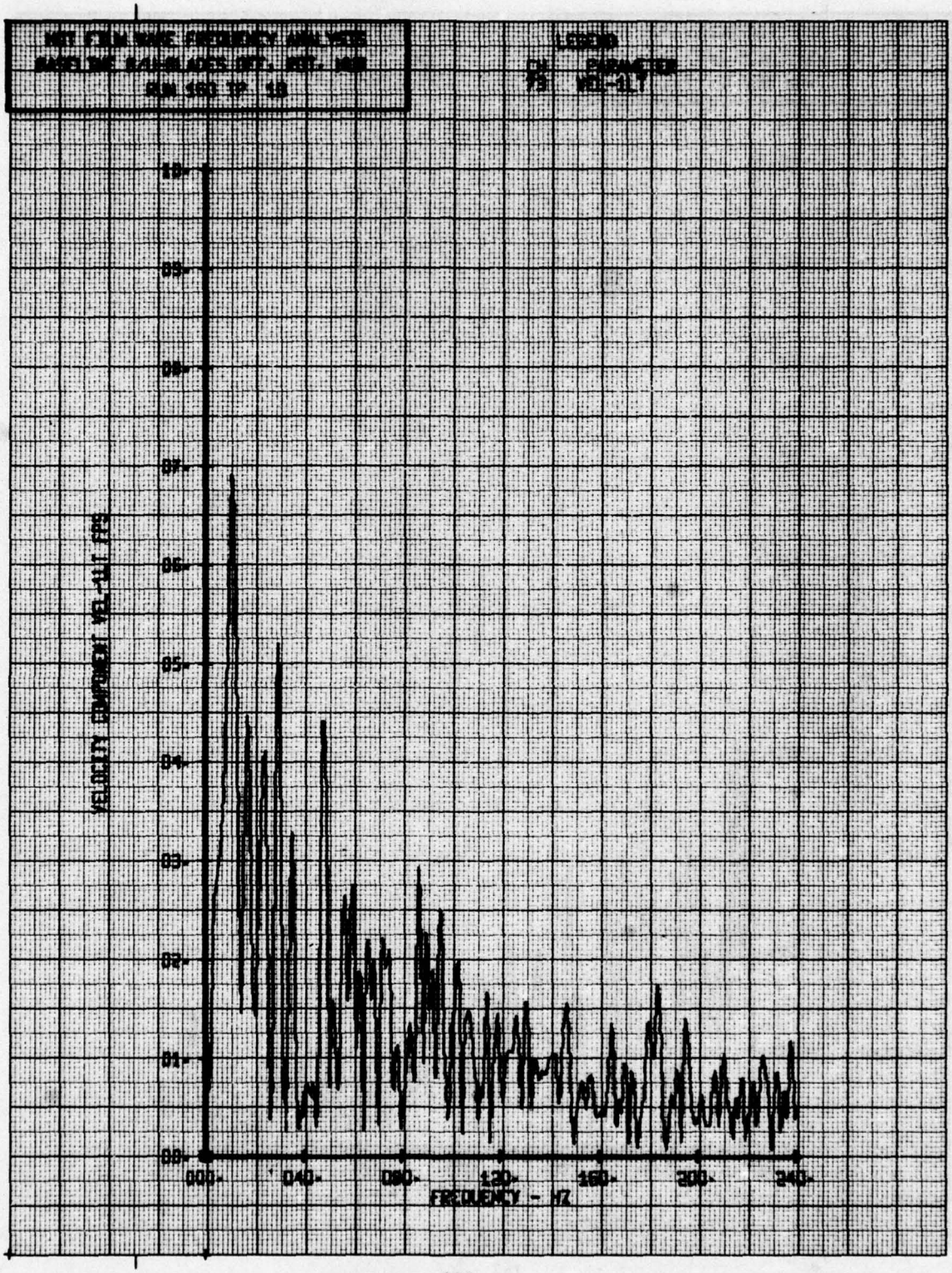

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE
LEGEND
CH PARAMETER
73 VEL.-ALT


FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
FREQUENCY - HZ
000-
040-
080-
120-
160-
200-
240-


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE R/U-BLADES OFF, REF. NUM
RUN 160 TP 8
LEGEND
CH PARAMETER
73 VEL-1LT
10
09
08
07
06
05
04
03
02
01
00
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
RUN 180 YP 9
LEGEND
CH FUNCTION
73 WEL-1LT
VELOCITY COMPONENT WEL-1LT FPS
FREQUENCY - PE


10-
09-
08-
07-
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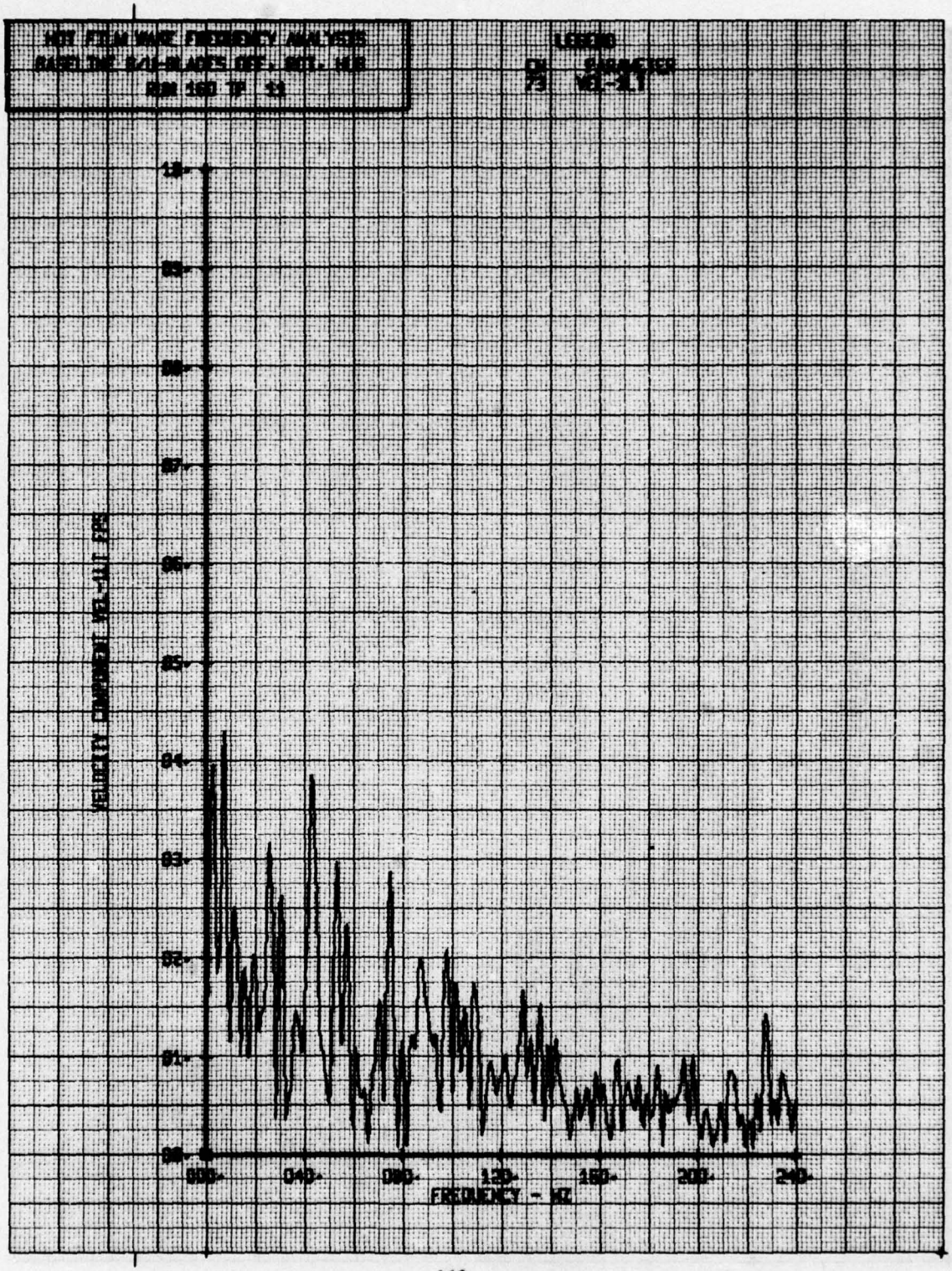
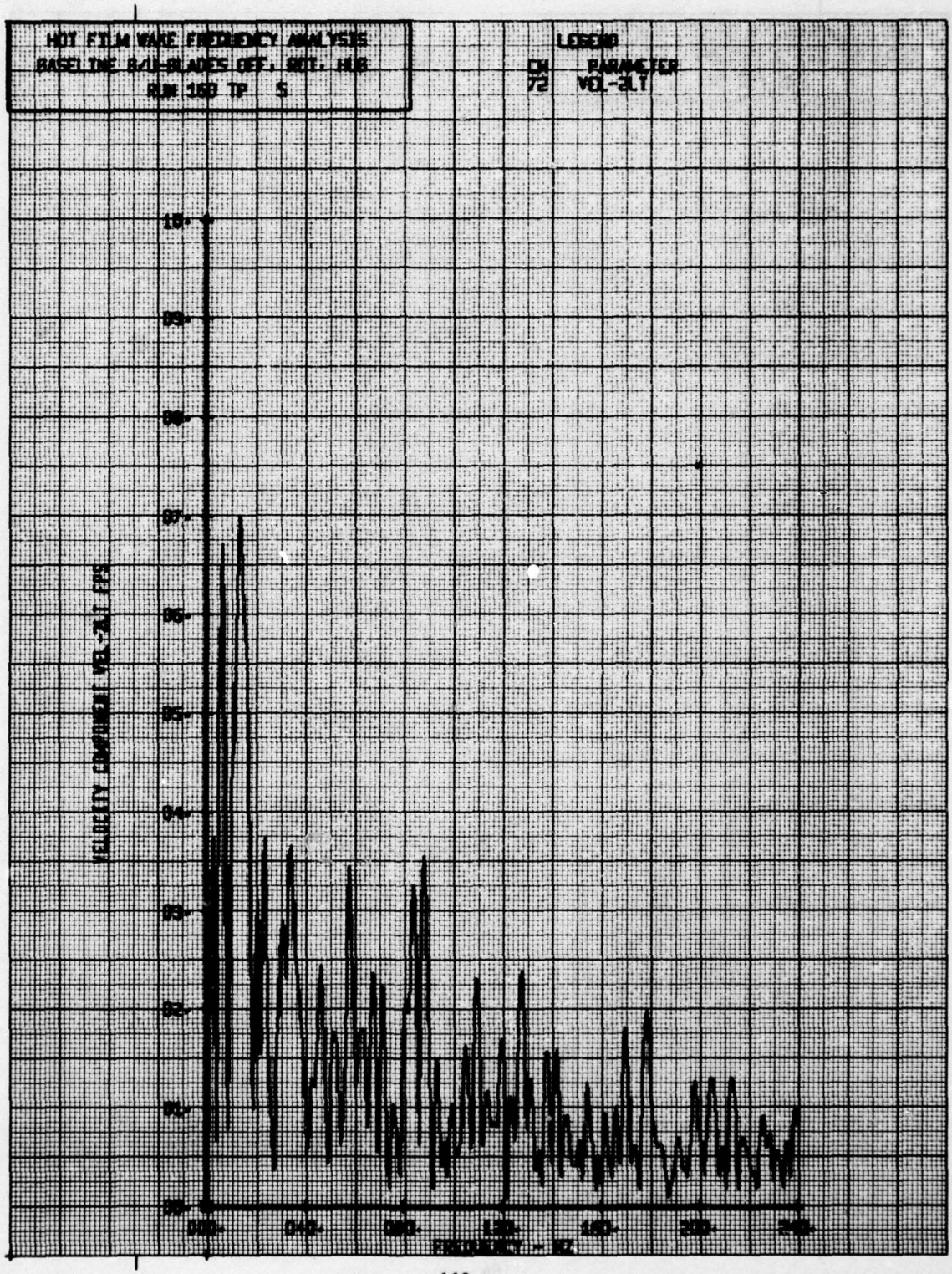
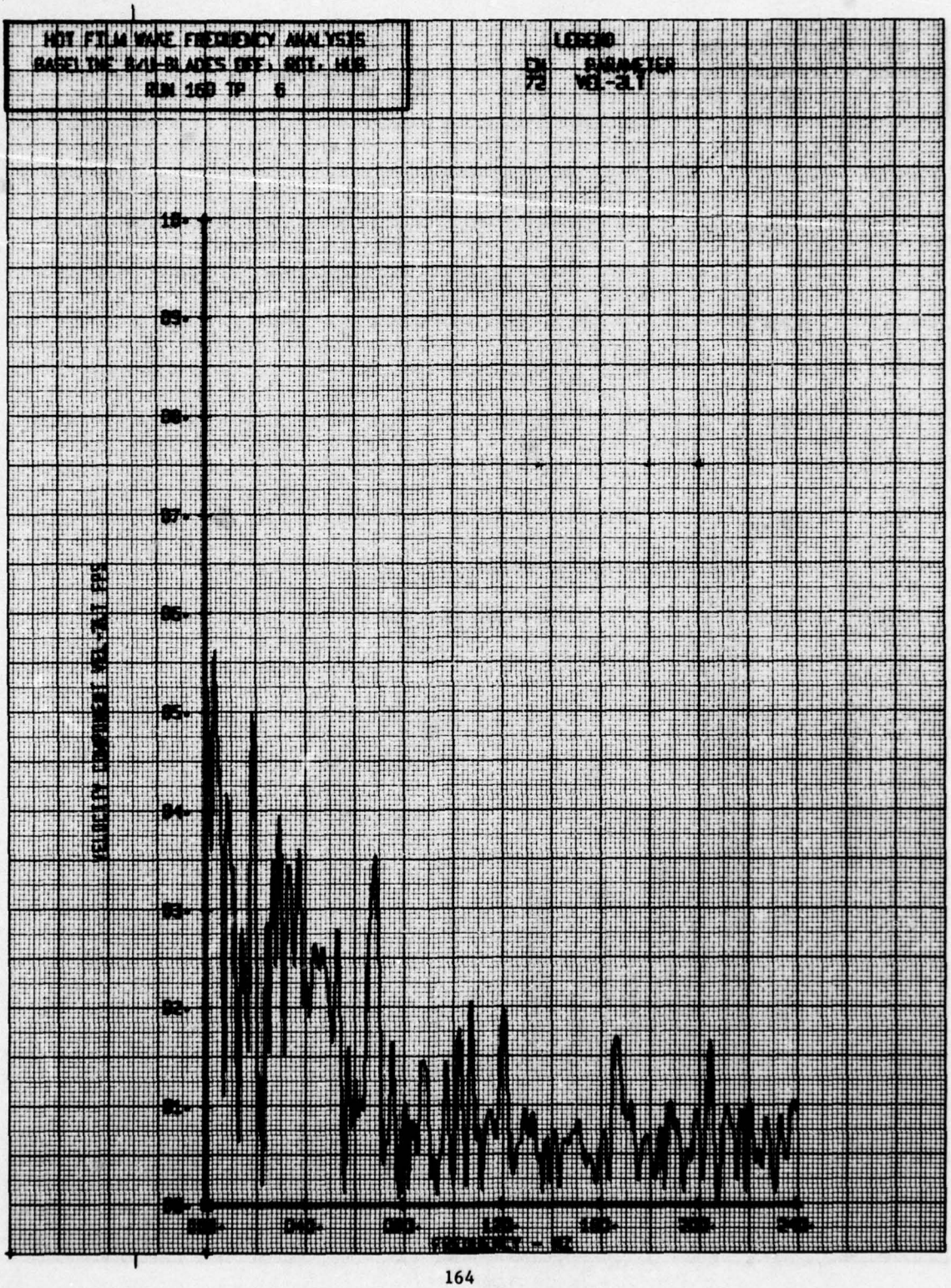
240-
FREQUENCY - HZ


FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE R/U-BLADES OFF, BOT. HUB
RUN 169 TP 5
LEGEND
CH PARAMETER
72 VEL-2LT
VELOCITY COMPONENT VEL-2LT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE 8/11-BLADES OFF, ROT. HUB
RUN 160 TP 6
LEGEND
CH PARAMETER
72 VEL-3.1
18
89
88
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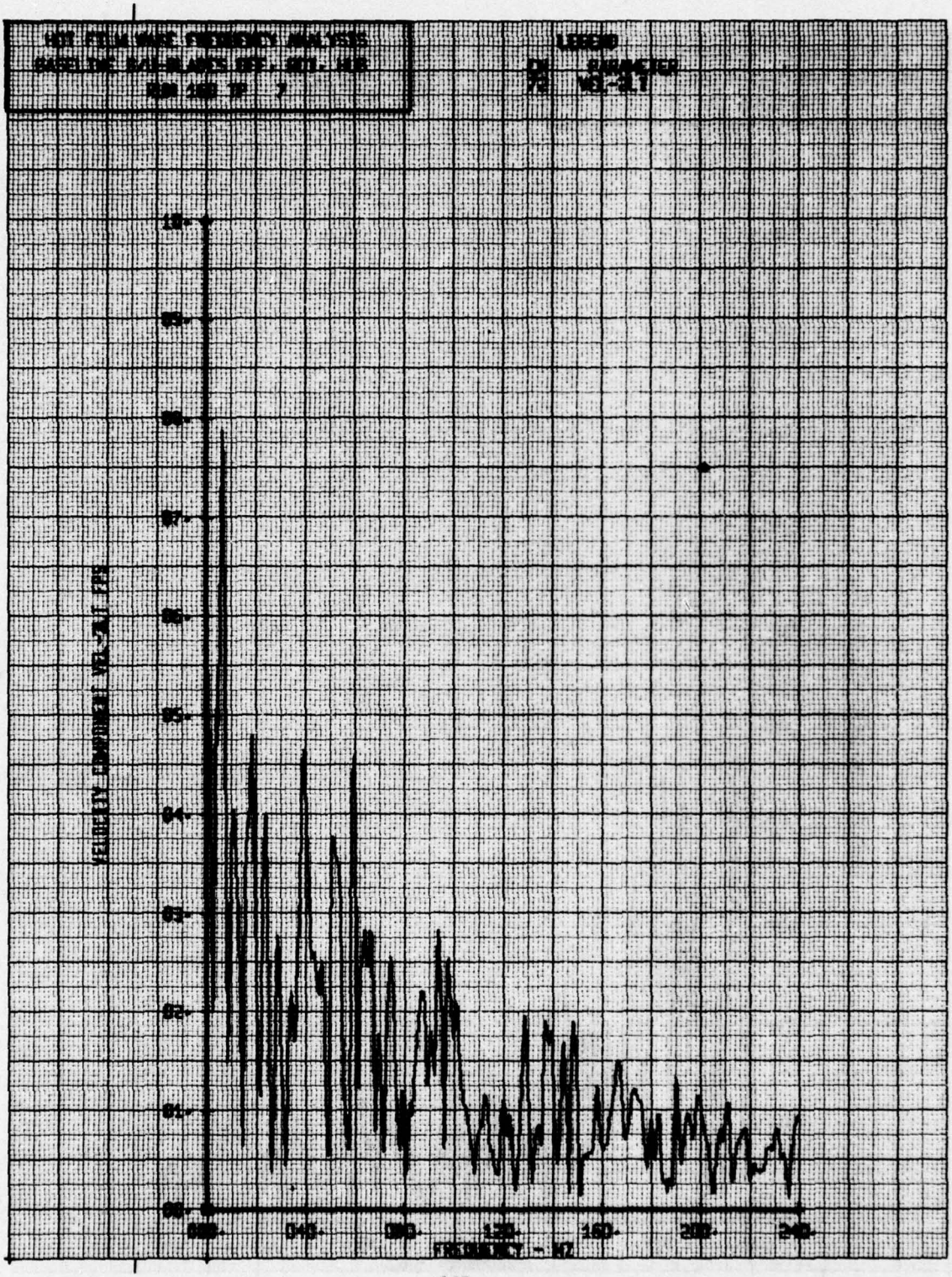
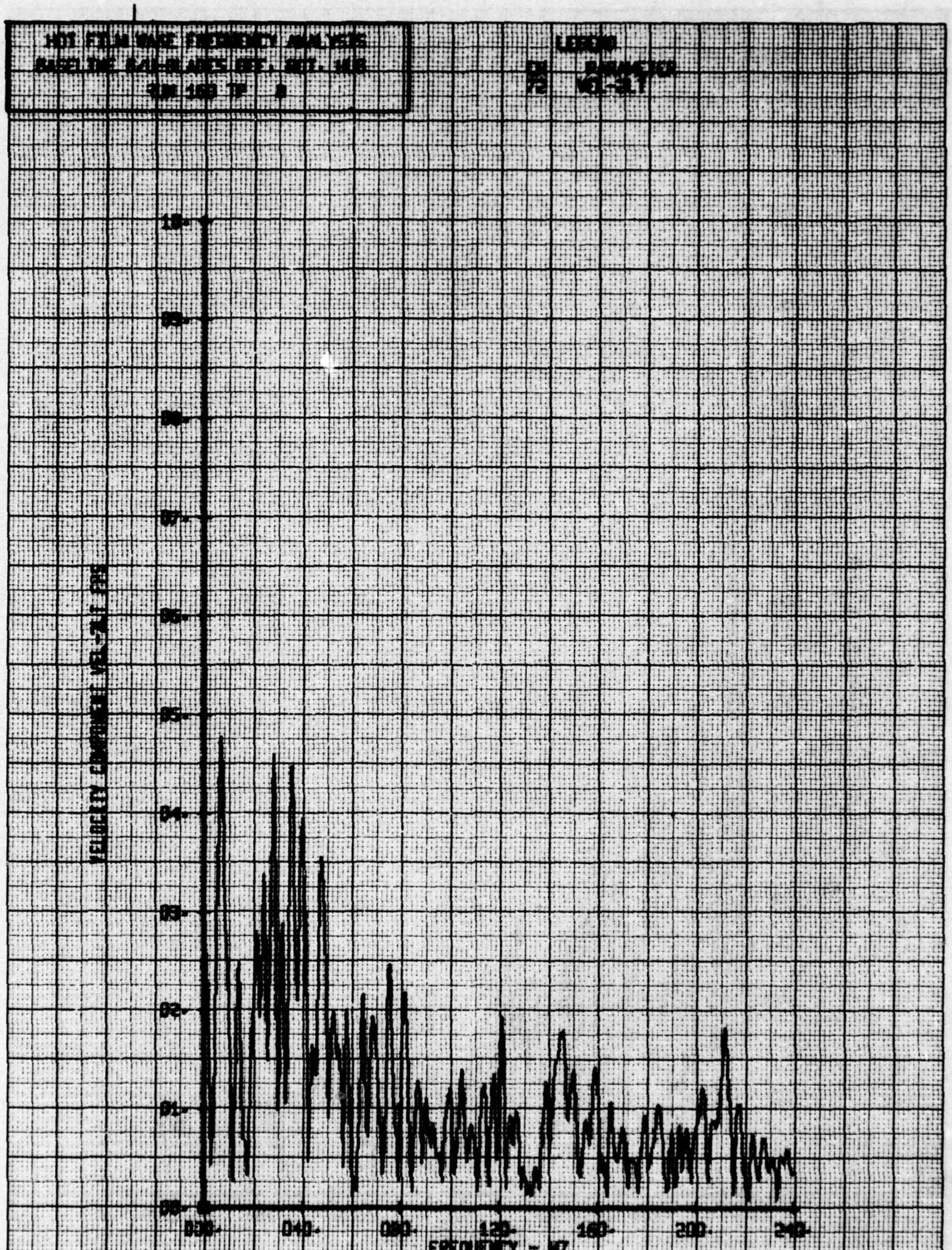
80
FREQUENCY - HZ


LEGEND
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
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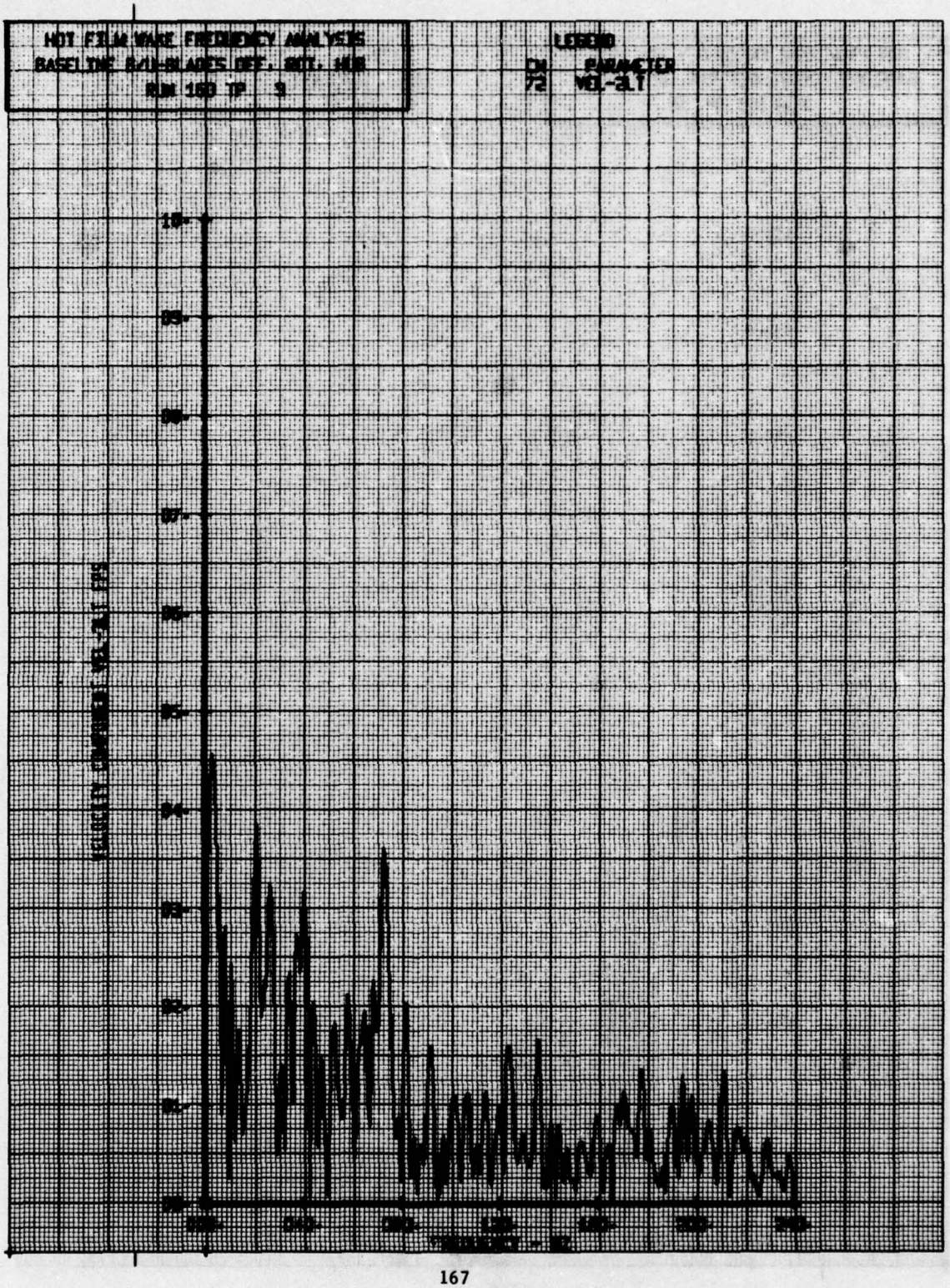
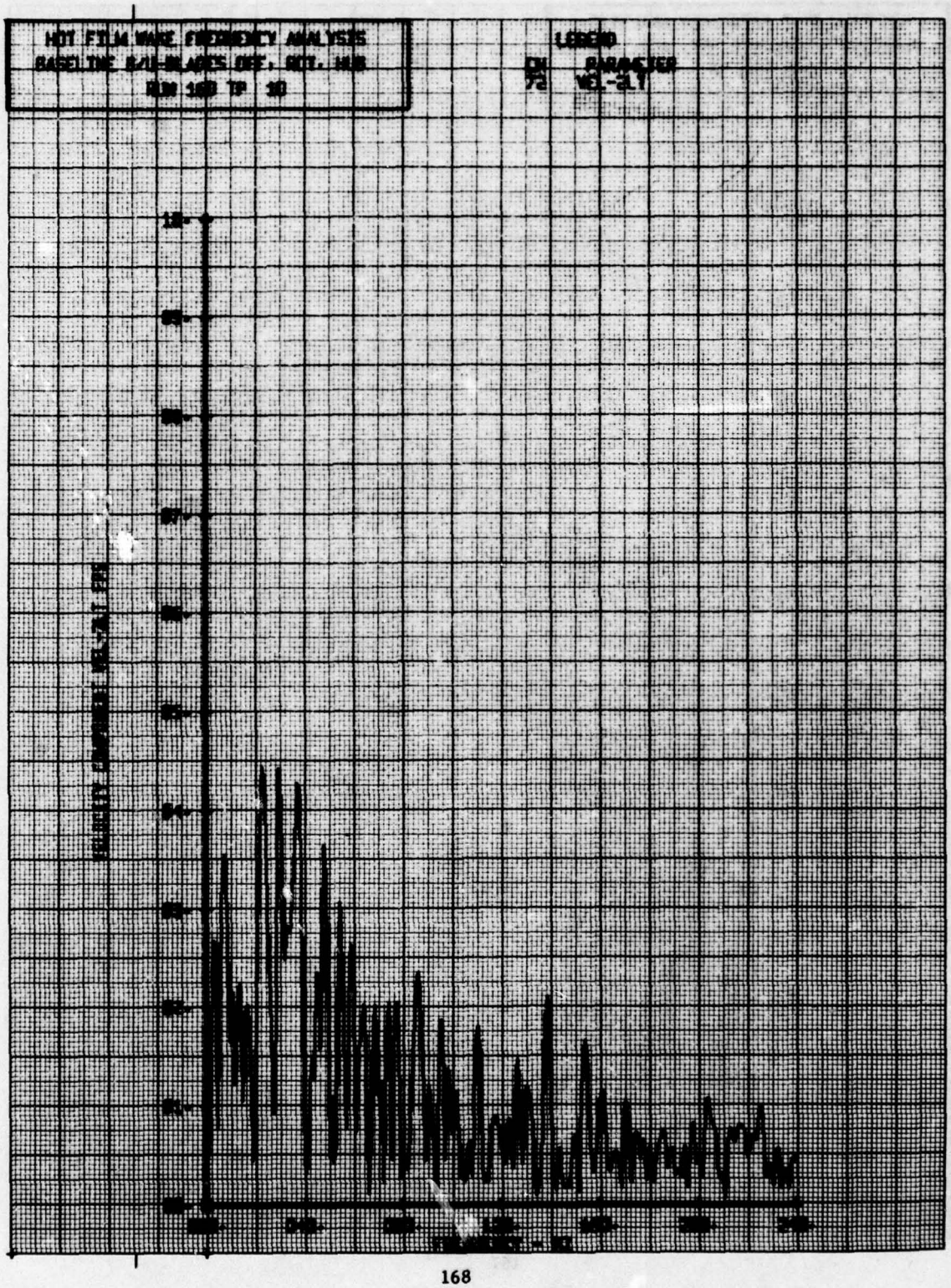
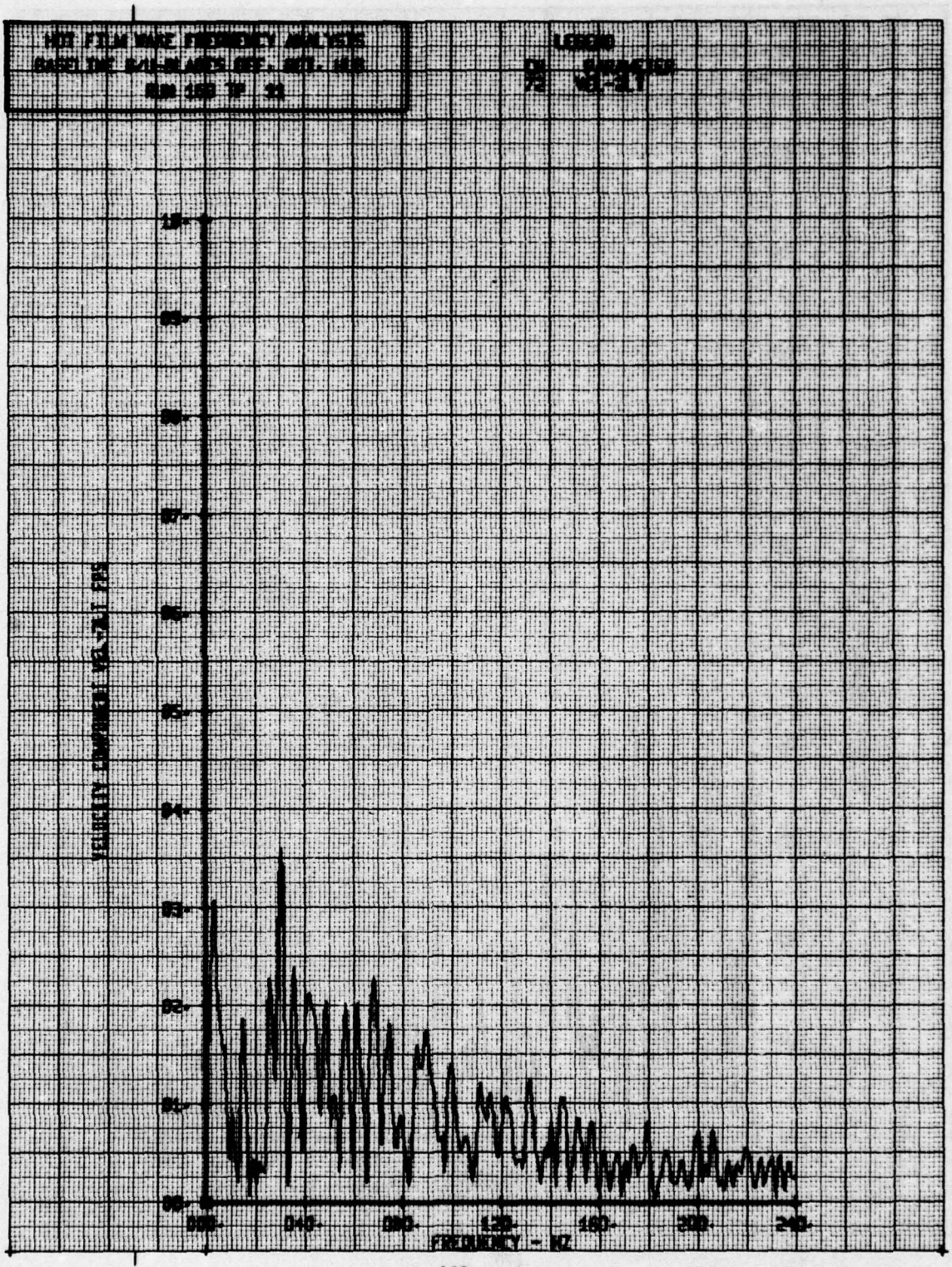
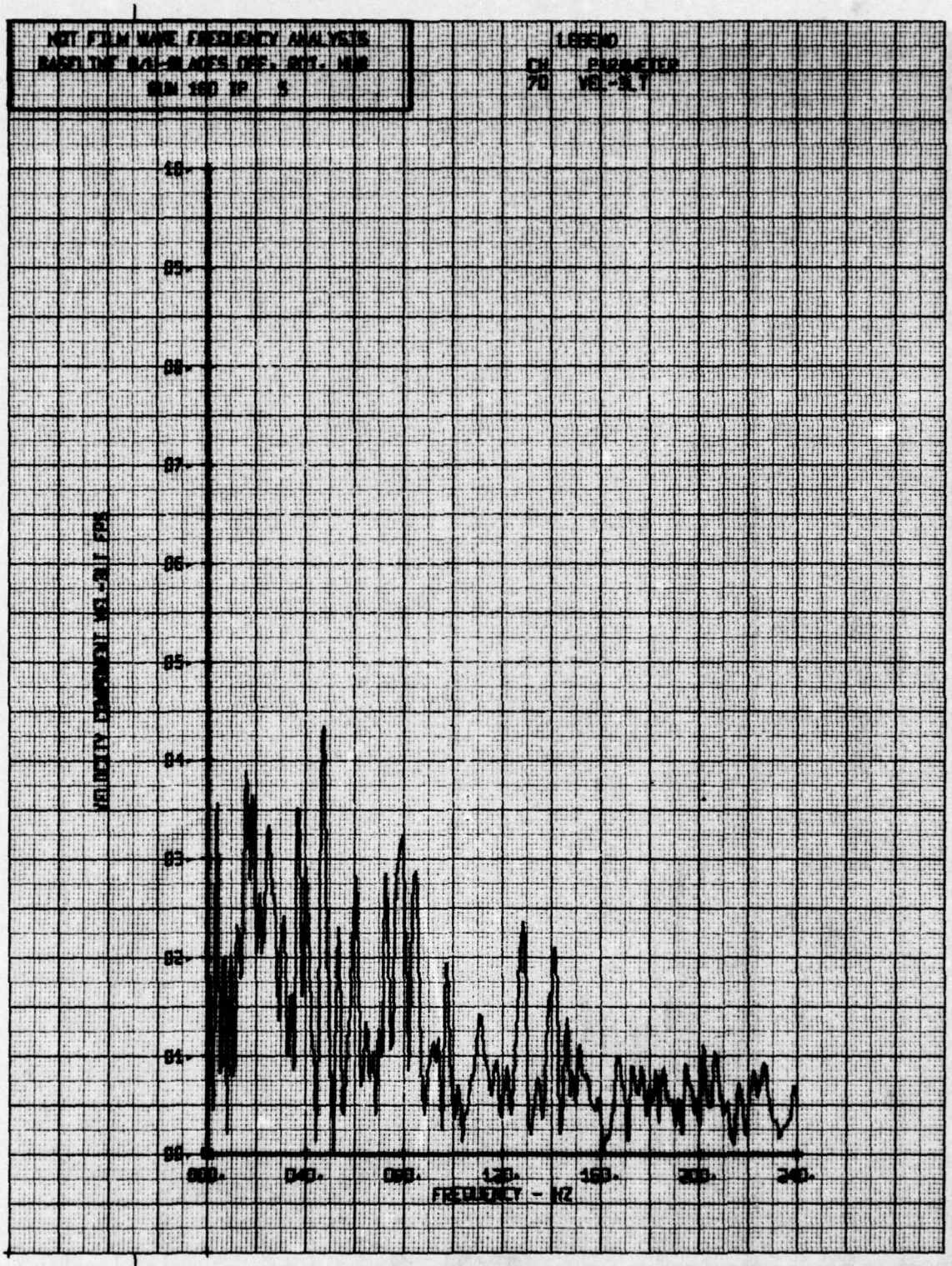
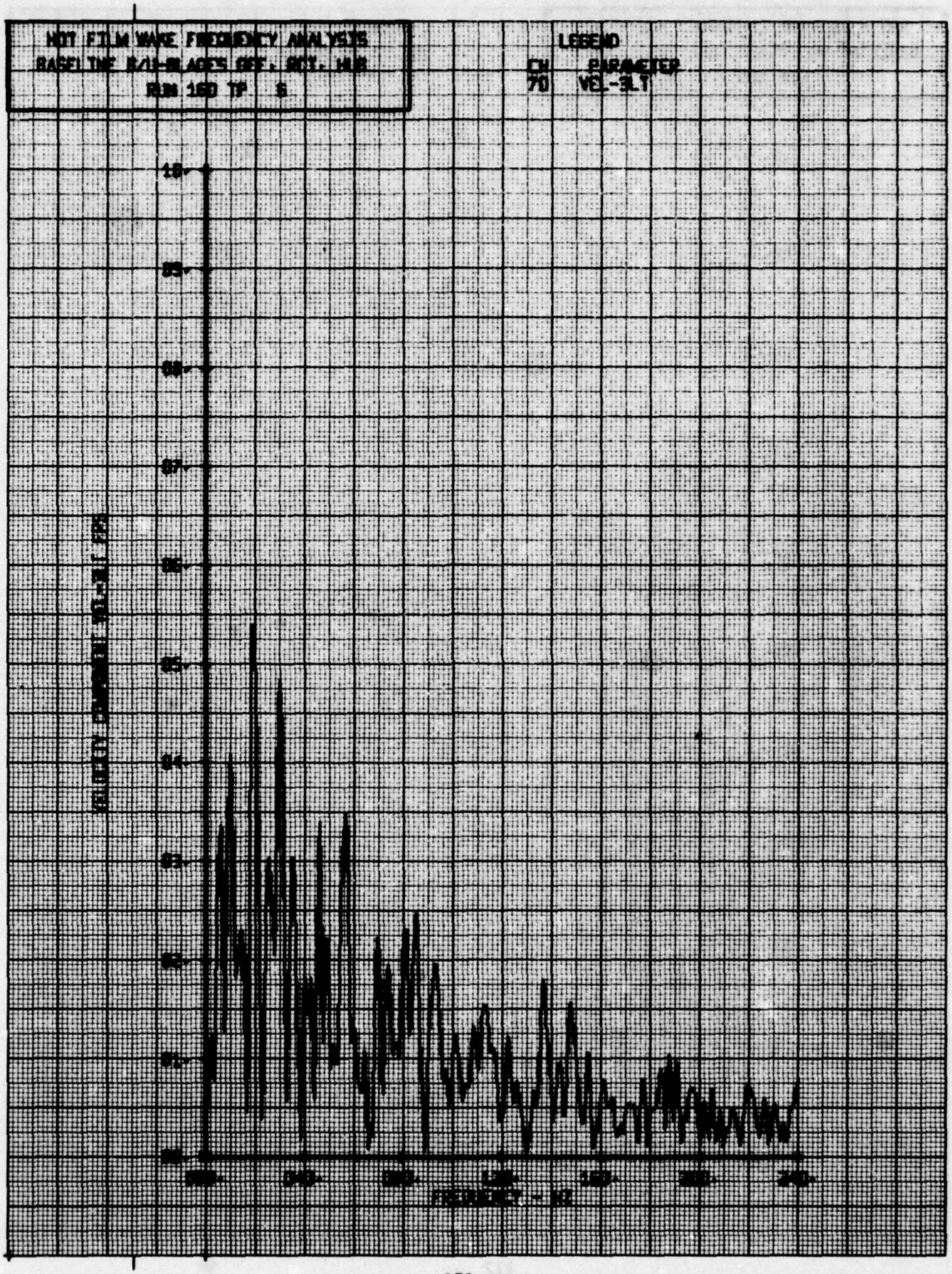
120
160
200
240
FREQUENCY - HZ

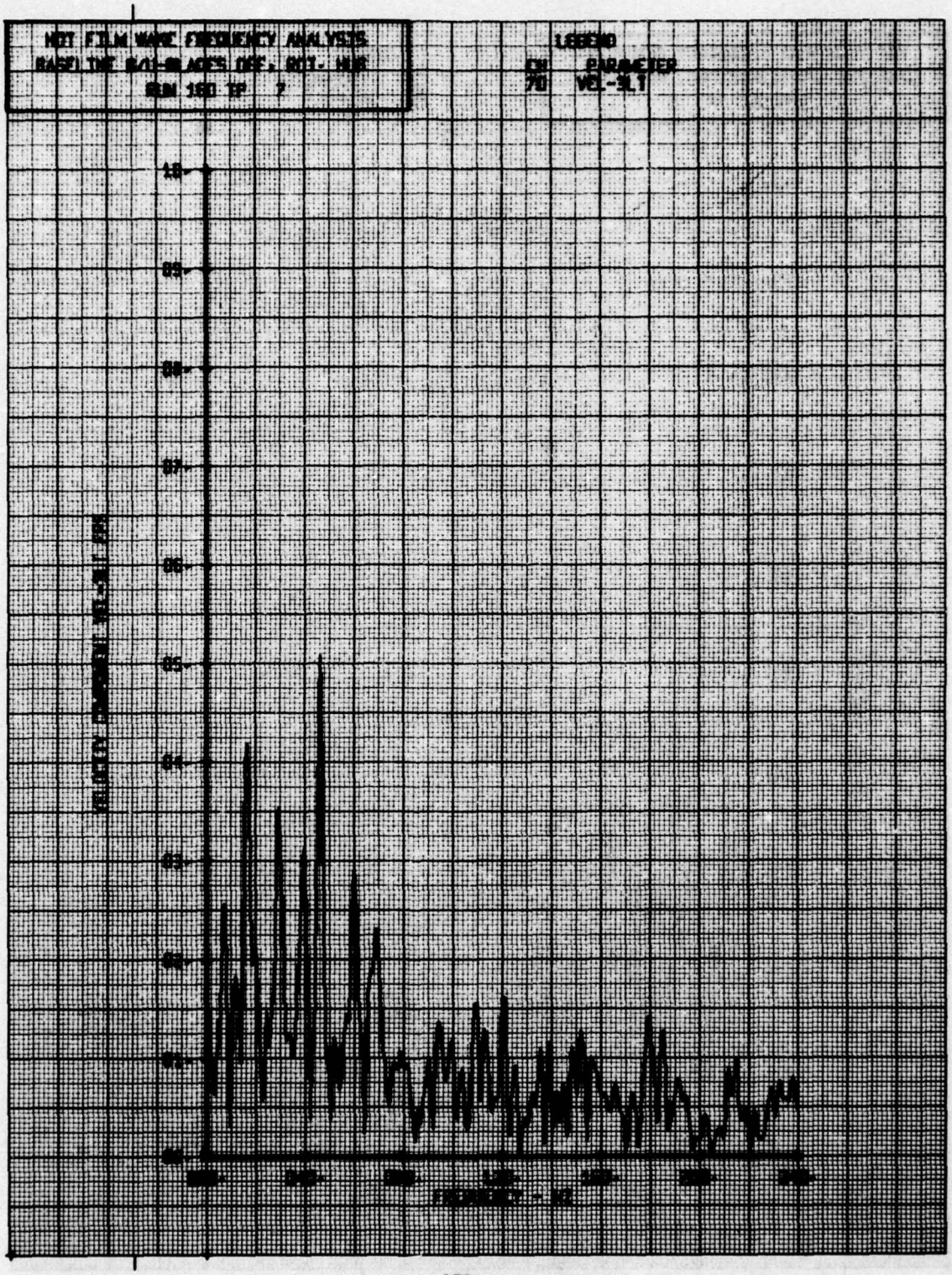

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE 8/0-BLADES OFF, ANTI, HUB
RUN 160 TP 9
LEGEND
CH PARAMETER
72 VEL-2LT


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE 6/11-BLADES OFF, OUT. HUB
RUN 160 TP 10
LEGEND
CH PARAMETER
72 VEL-AZ
18
FREQUENCY (CYCLES PER REVOLUTION)


HOT FILM WAKE FREQUENCY ANALYSIS
LEGEND
FREQUENCY - HZ


LEGEND
CH PARAMETER
70 VEL.-SLT
VELOCITY COMPONENT VEL.-SLT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE R/I-BLADES OFF, SOT, HUB
RUN 160 TP 6
LEGEND
CH PARAMETER
70 VEL.-SLT
FREQUENCY - HZ


NOT FILM WAVE FREQUENCY ANALYSIS
LEGEND
CH PARAMETER
70 VEL-ELT
89
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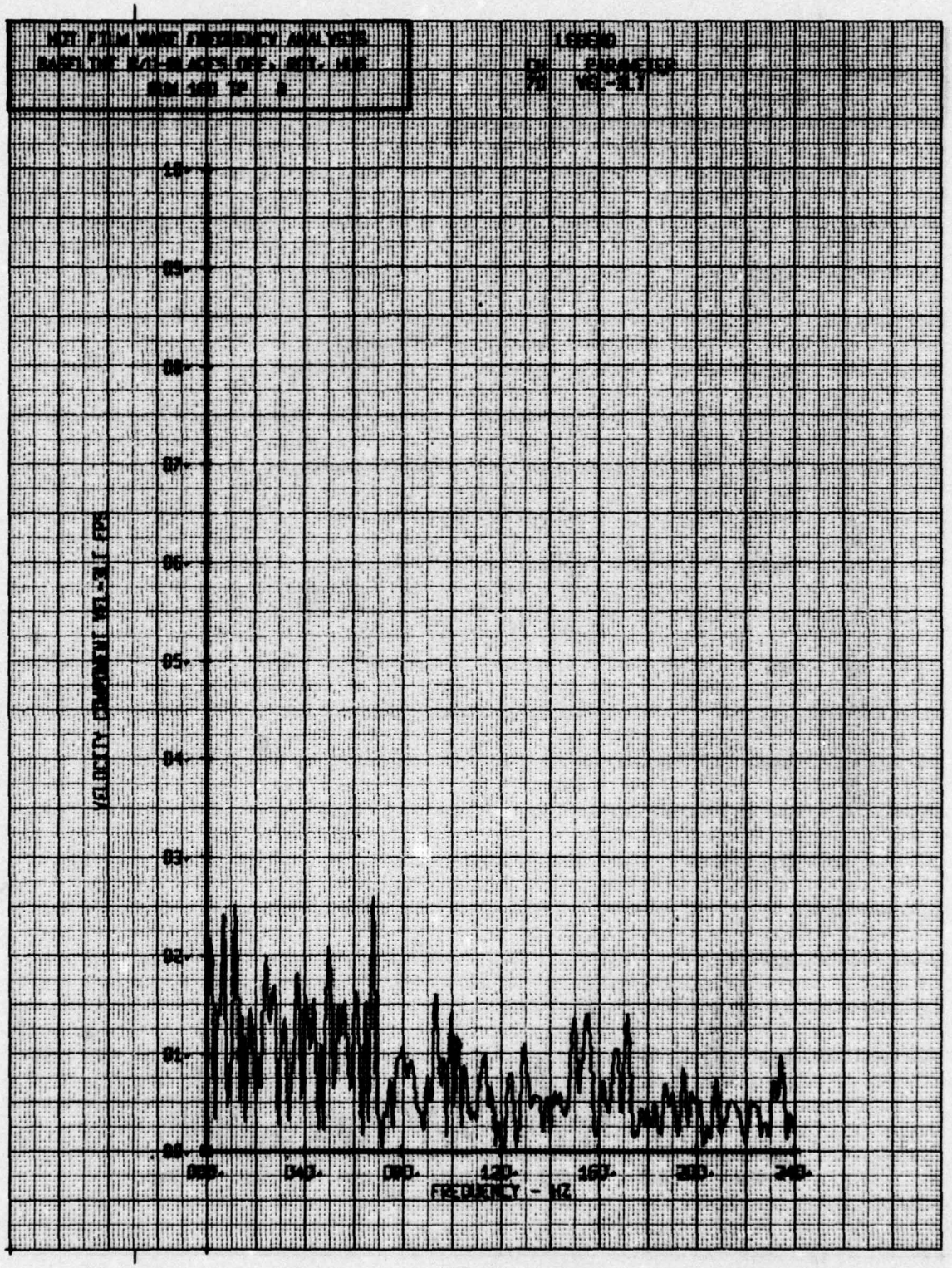
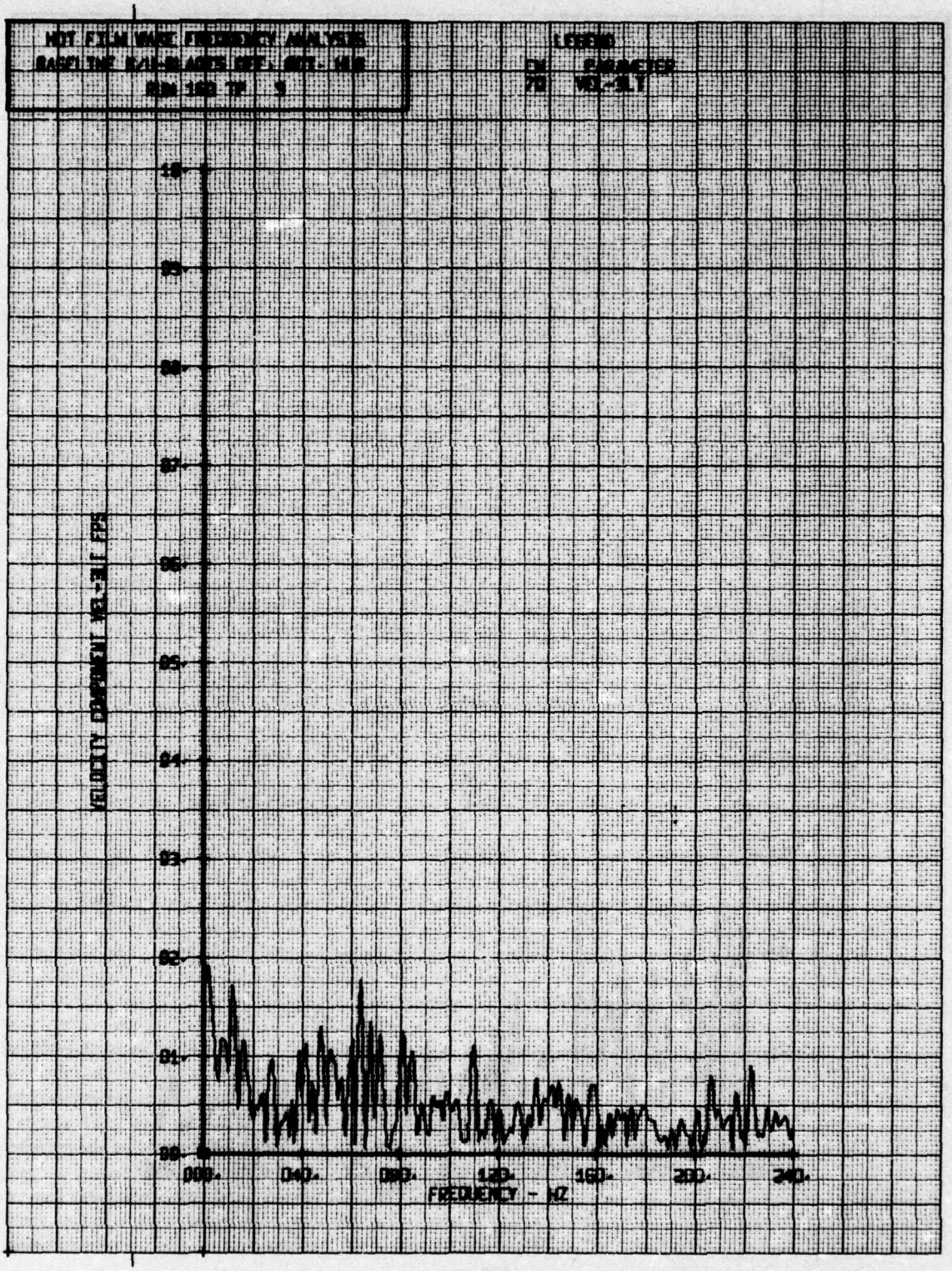
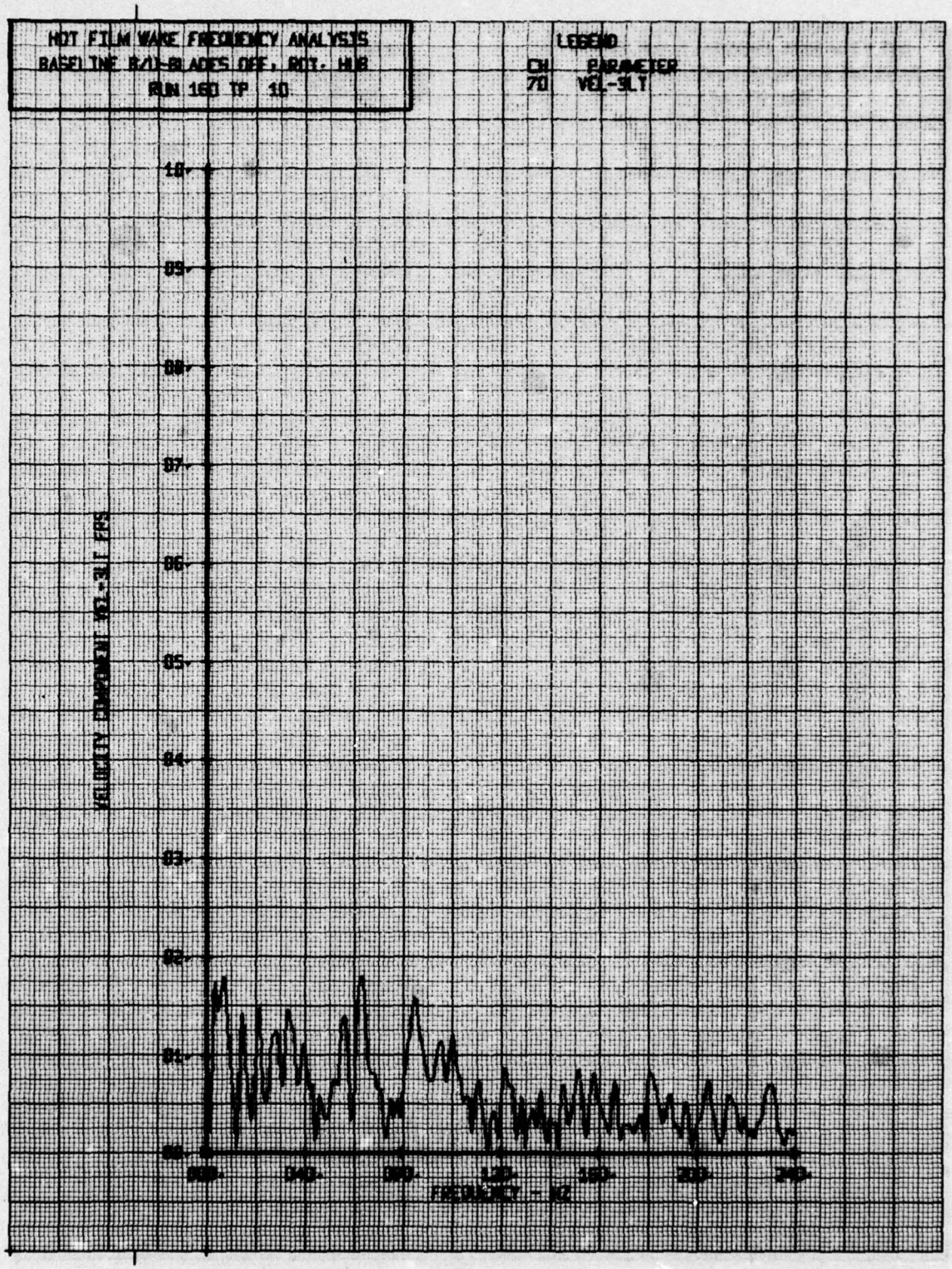
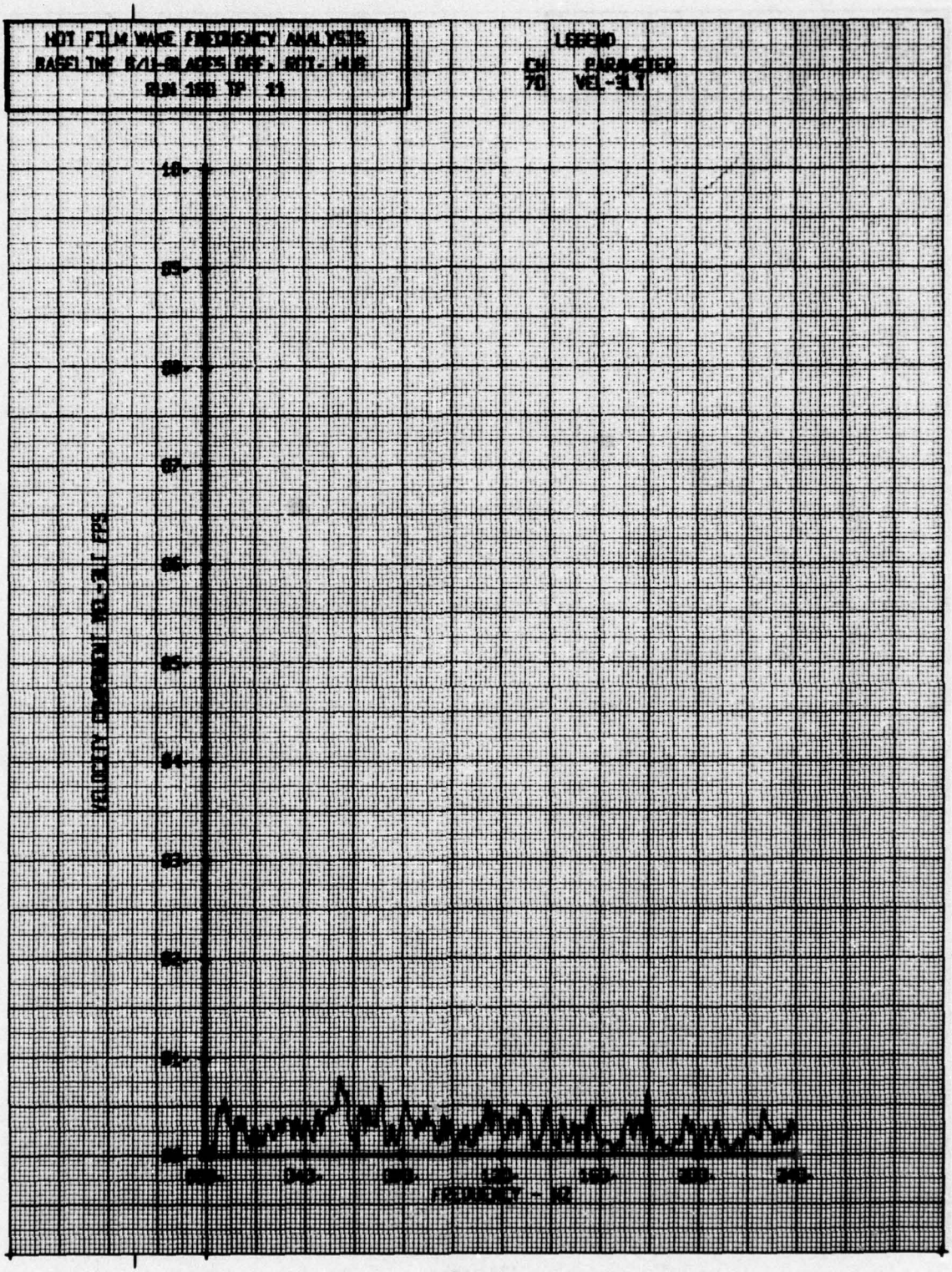
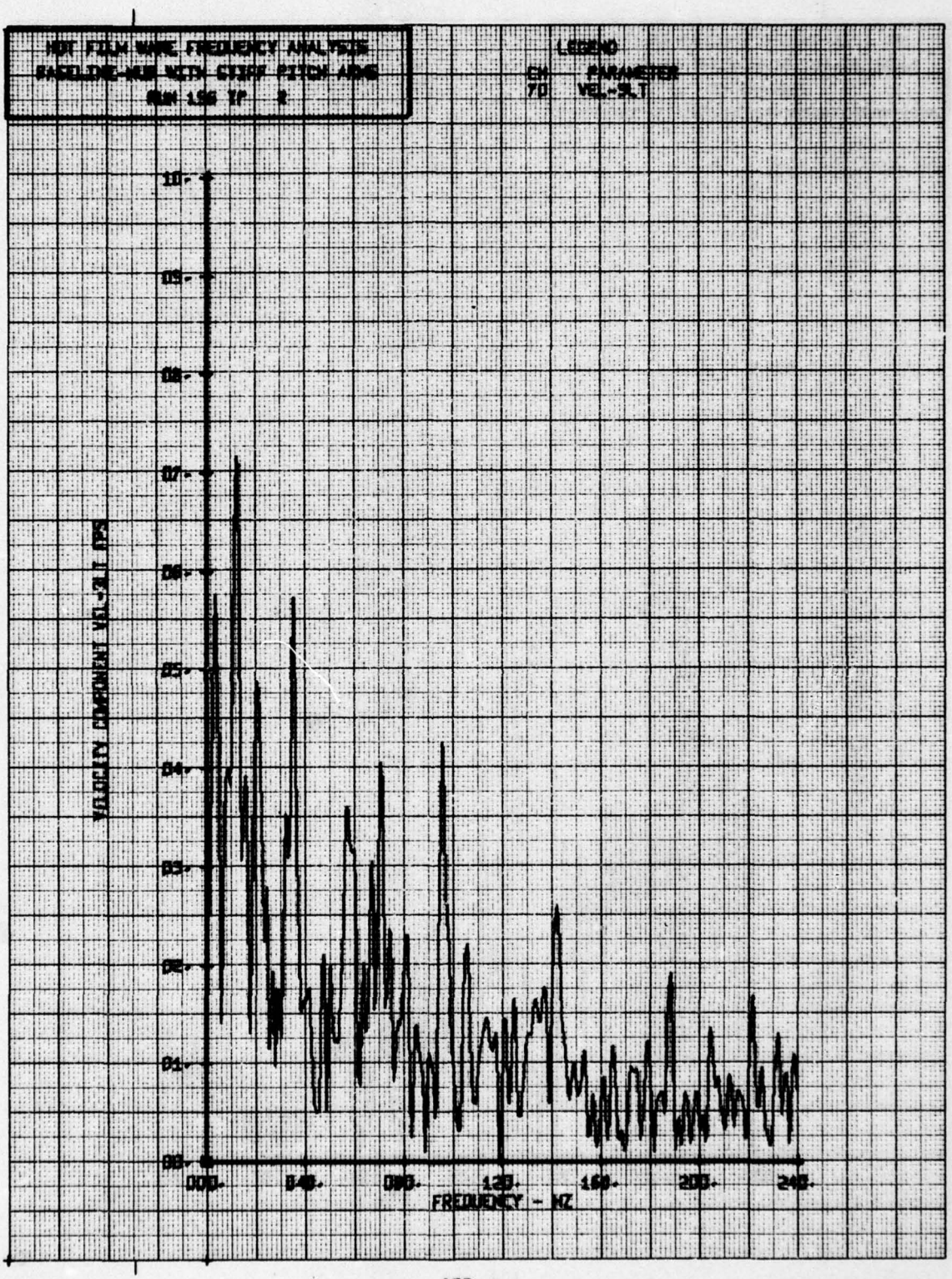

LEGEND
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
RUN 160 TP 5
LEGEND
CH CHARACTER
70 VEL-3LT
VELOCITY COMPONENT VEL-3LT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE R/I-BLADES OFF, ROT. HUB
RUN 160 TP 10
LEGEND
CH PARAMETER
70 VEL.-3LT
VELOCITY COMPONENT VEL.-3LT FPS
FREQUENCY - KZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE R/I-BLADES REF. ROT. HUB
RUN 180 TP 11
LEGEND
CH PARAMETER
70 VEL-3LT
VELOCITY COMPONENT NO.3LT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BACKLINE-WAKE WITH CYCOP PITCH ADDS
RUN 156 TP 2
LEGEND
CH PARAMETER
70 VEL-SLT
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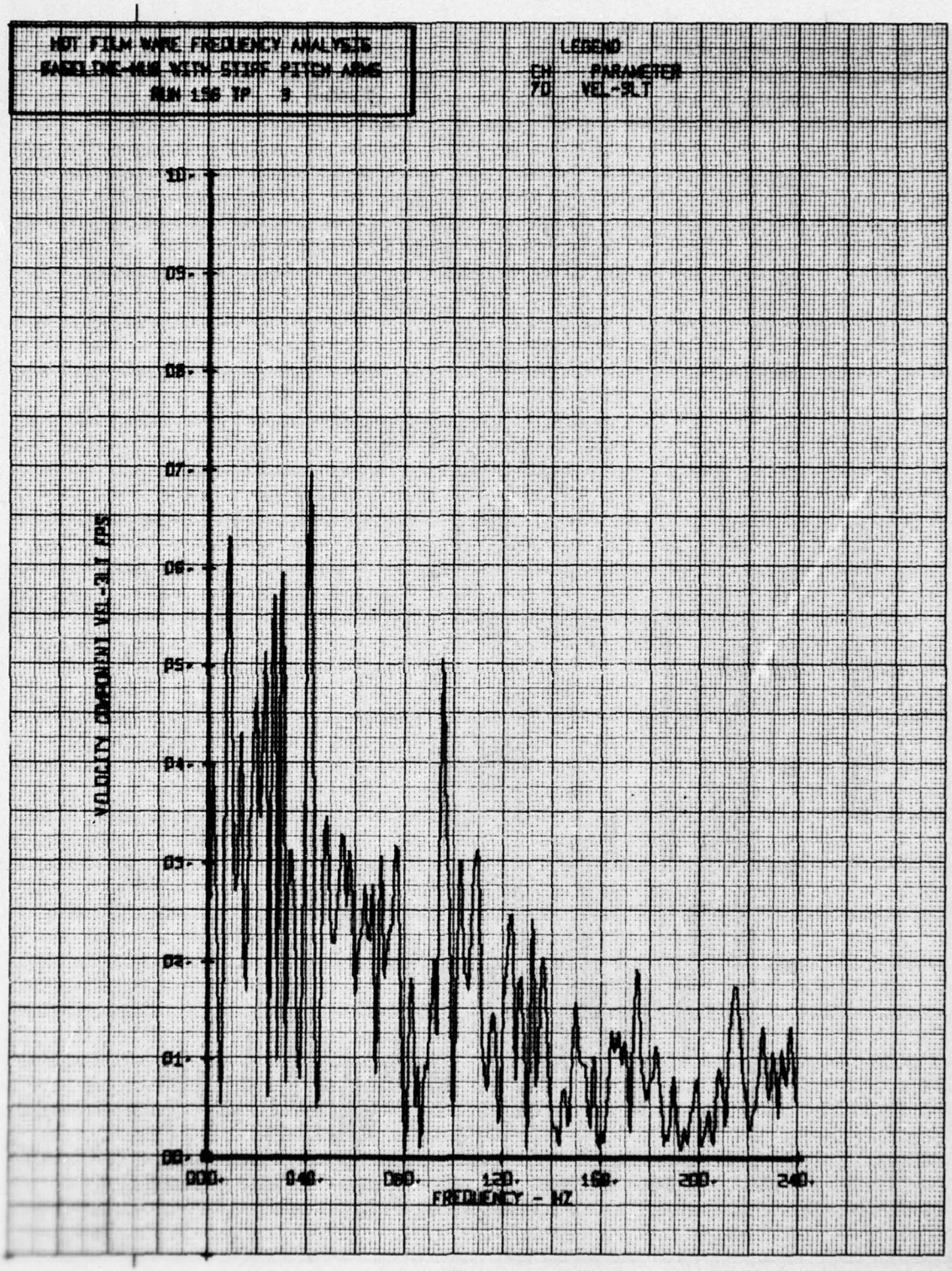
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 9
LEGEND
CH PARAMETER
70 VEL-3LT
VELOCITY COMPONENT VEL-3LT FPS
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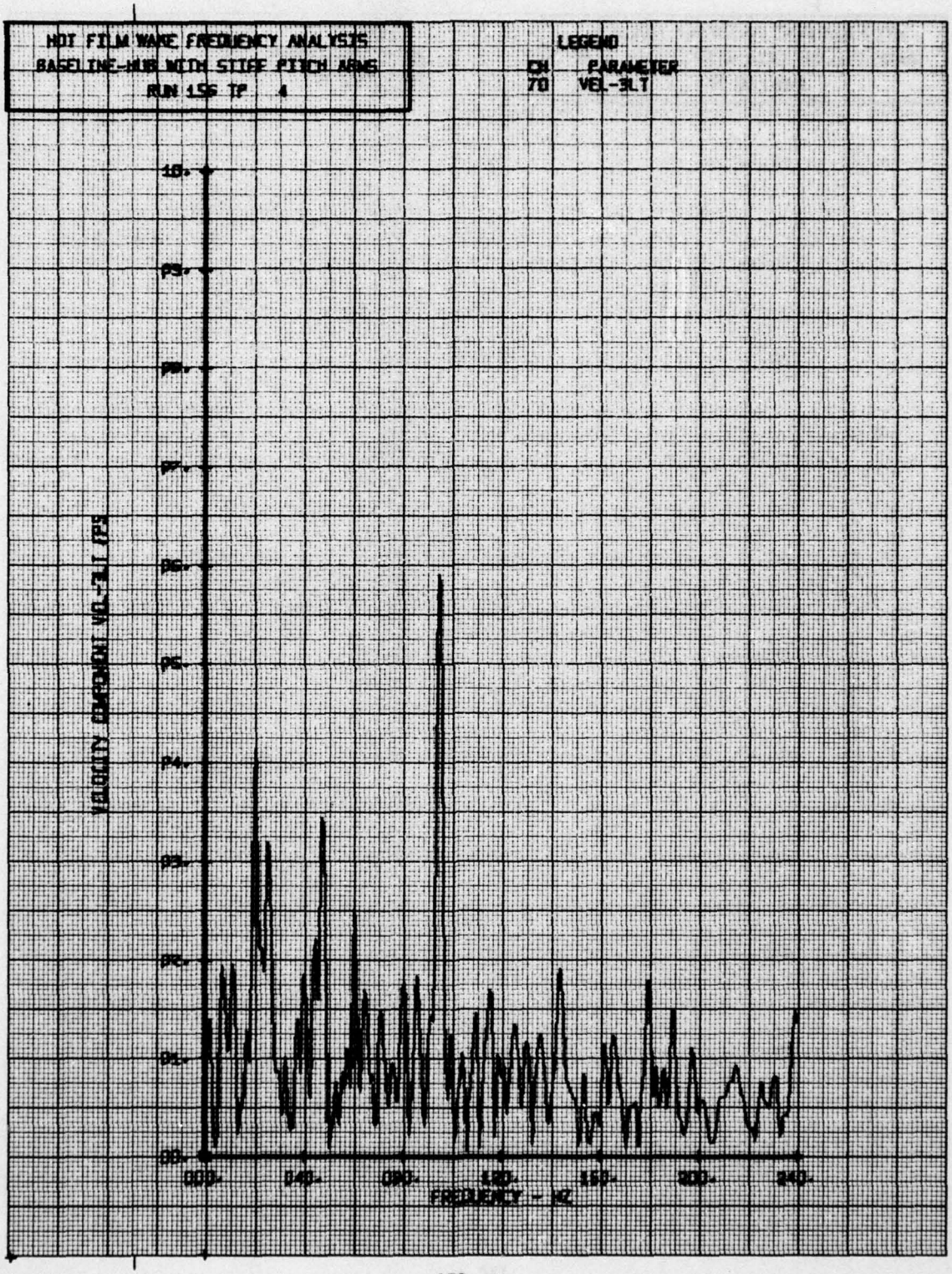
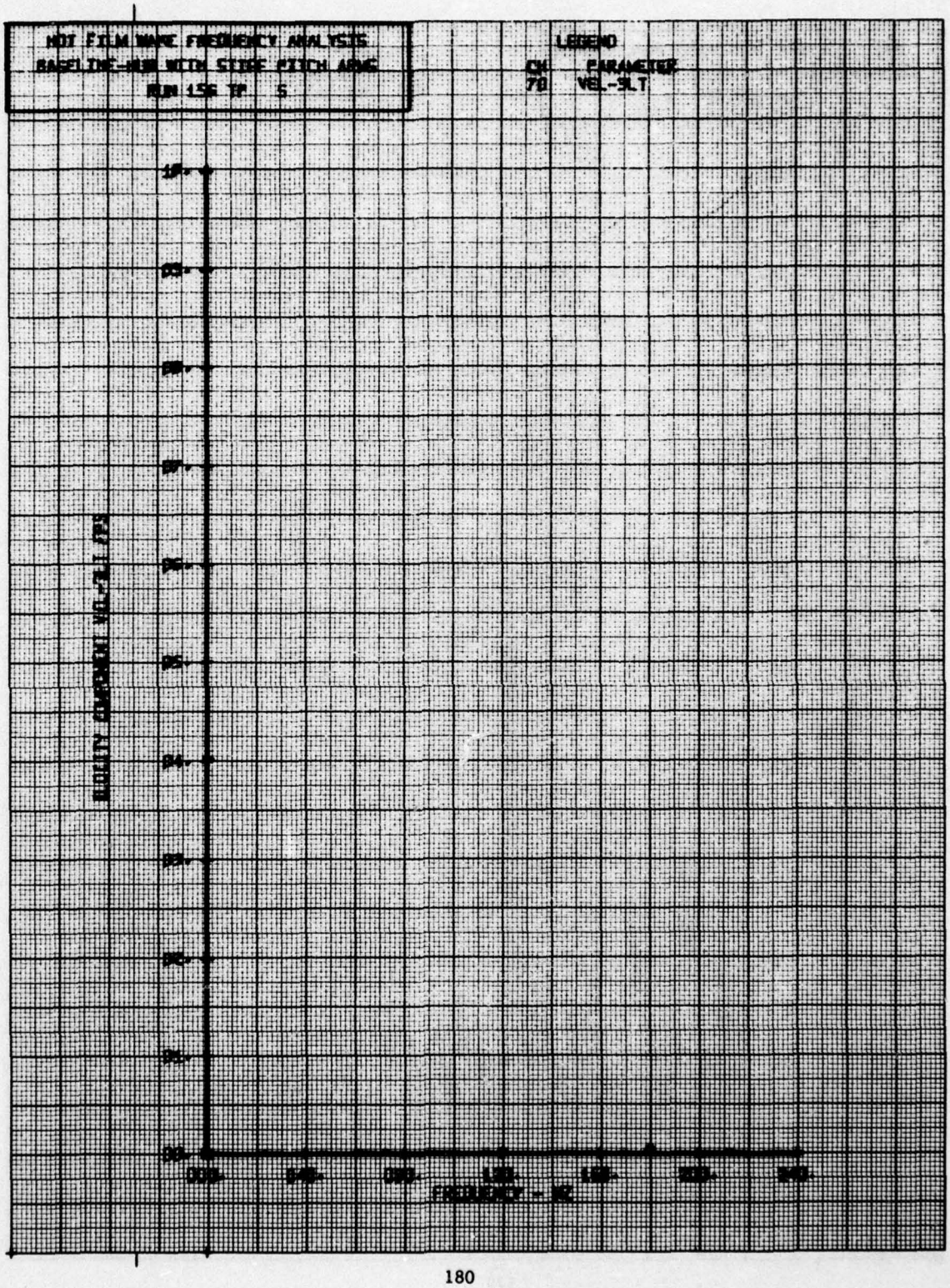
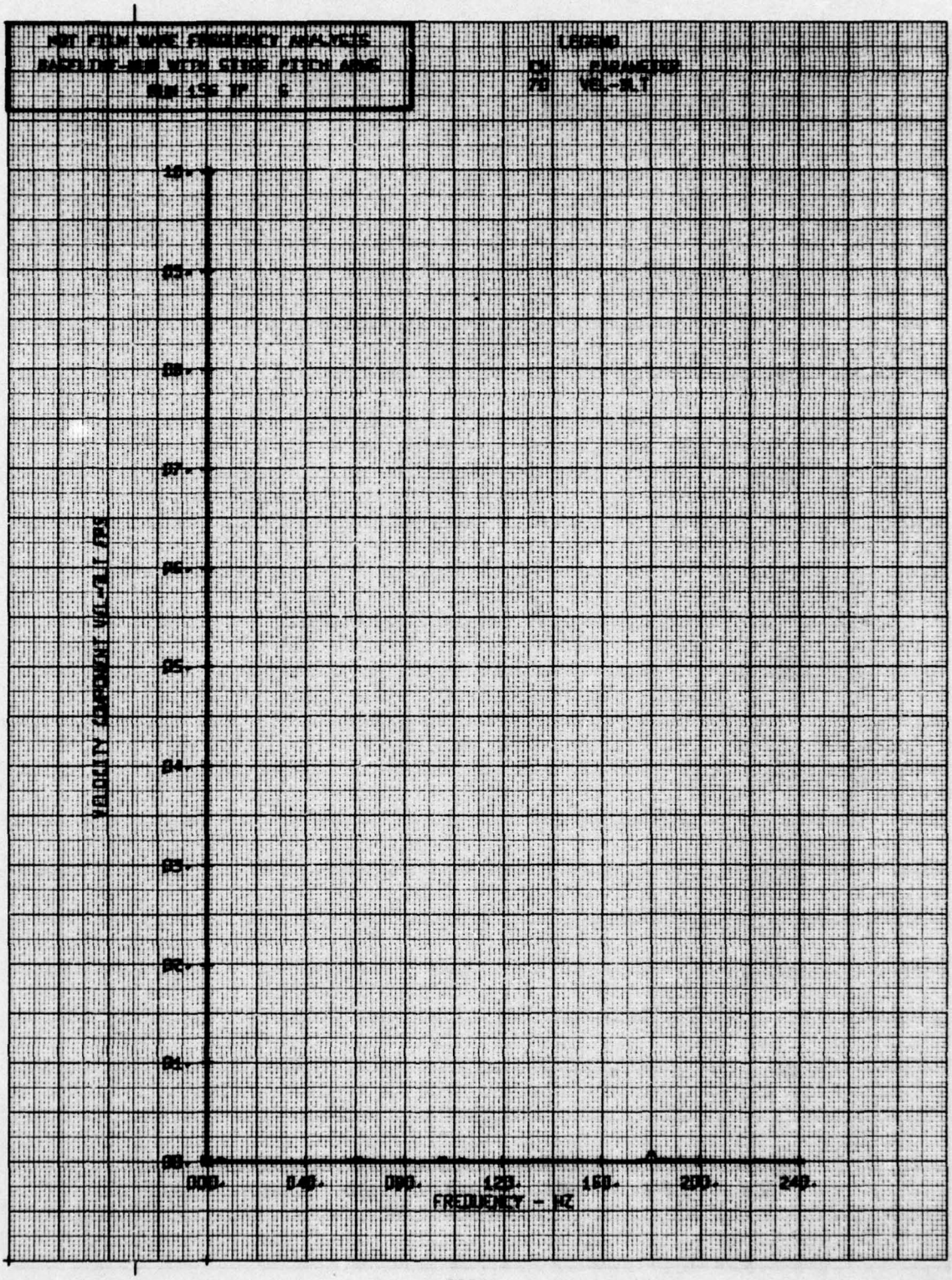
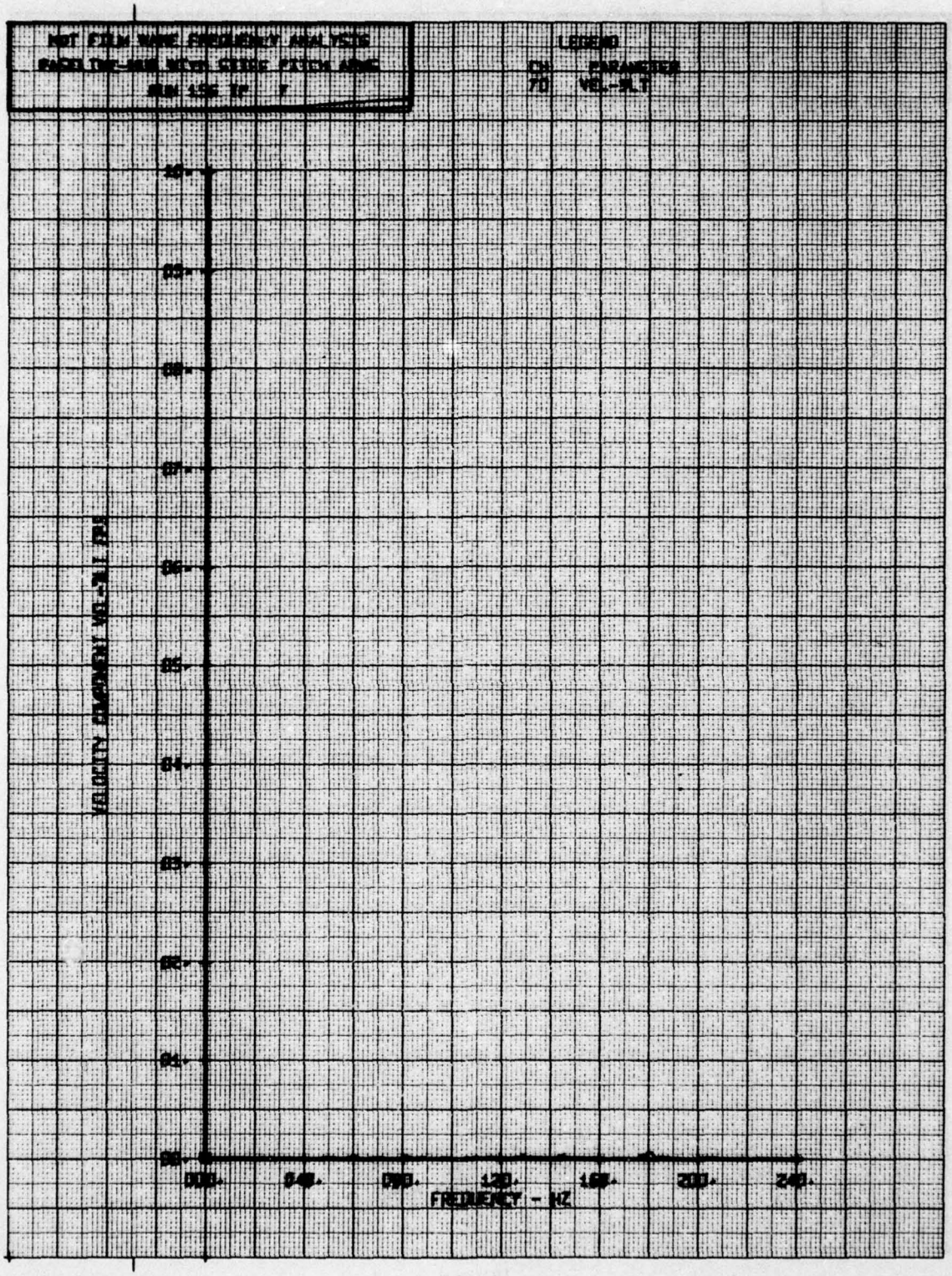
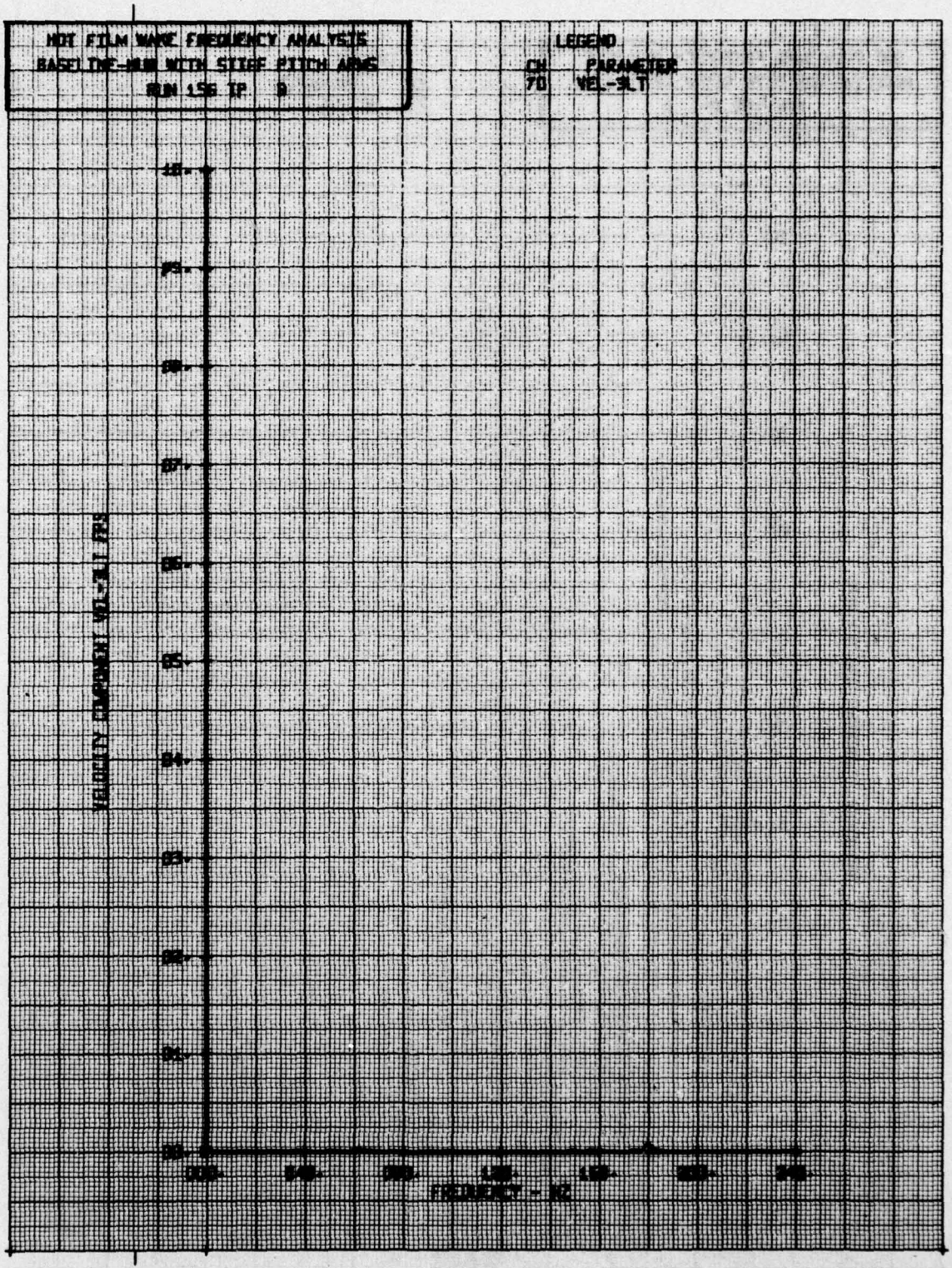
FREQUENCY - HZ

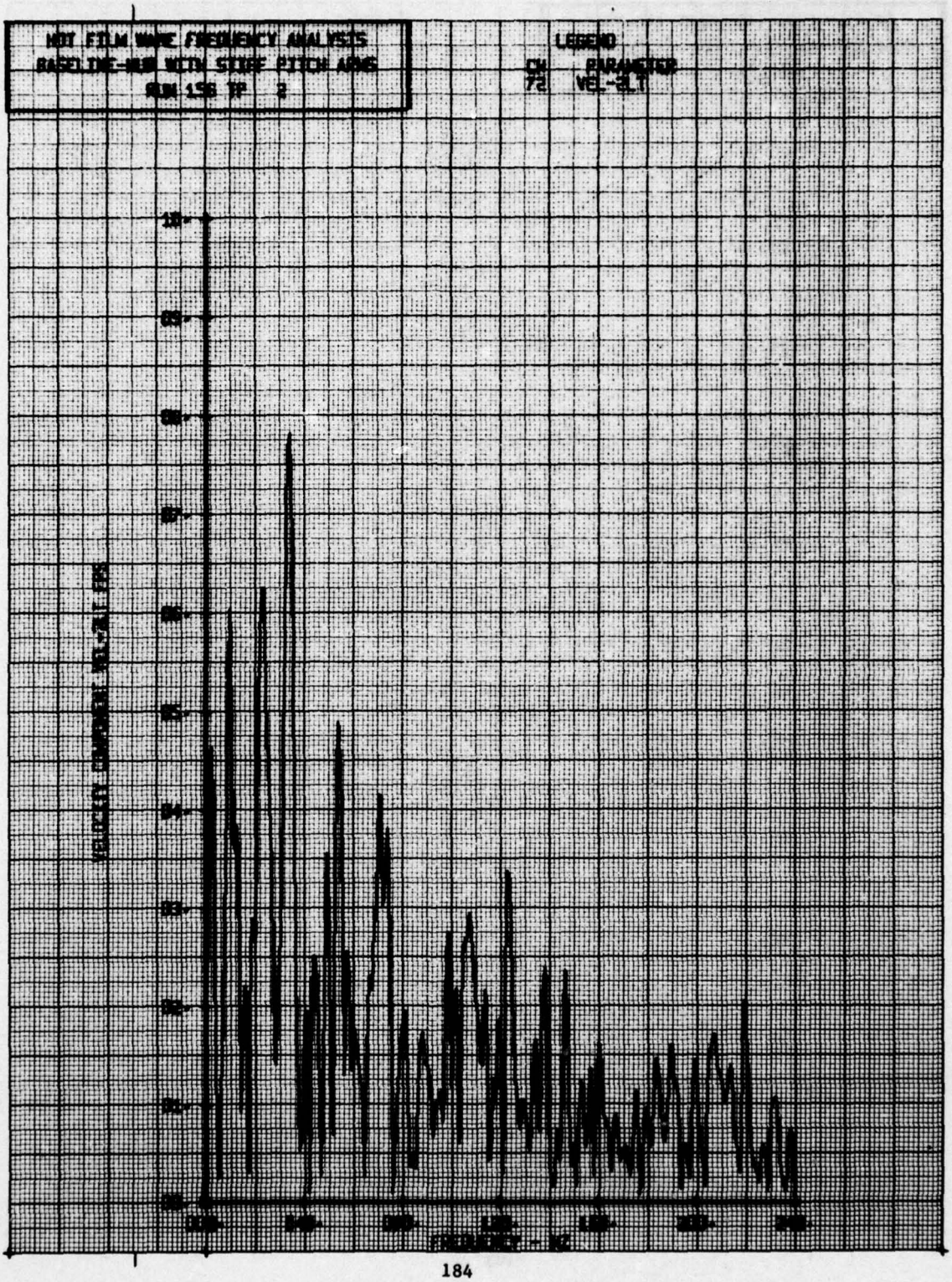

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 4
LEGEND
CH PARAMETER
70 VEL-3LT
VELOCITY COMPONENT VEL-3LT (FPS
FREQUENCY - HZ

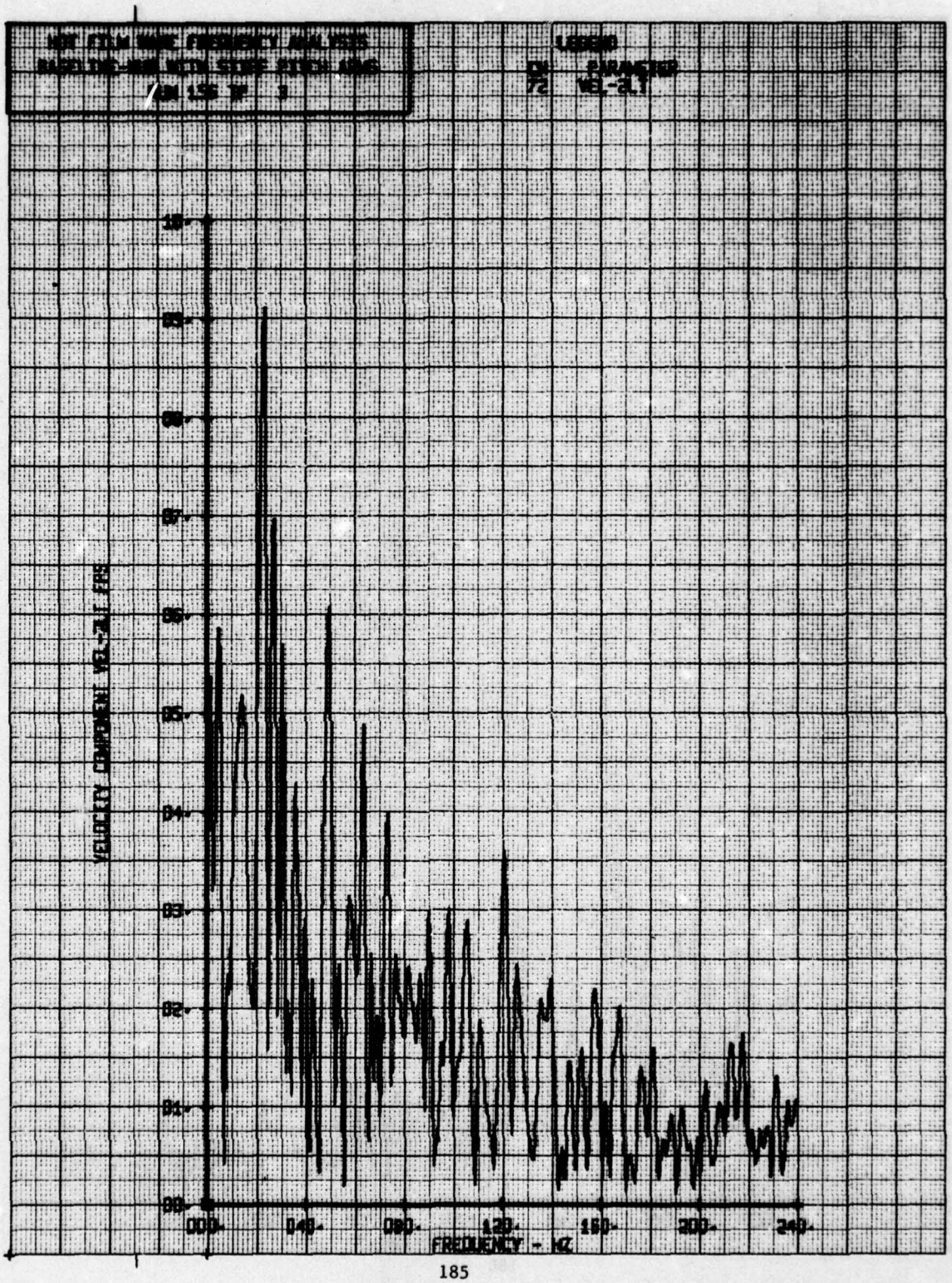

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STUB PITCH ARMS
RUN 156 TP 5
LEGEND
CH PARAMETER
78 VEL-SLT
RADIAL COMPONENT VEL-ALLIES
FREQUENCY - KC

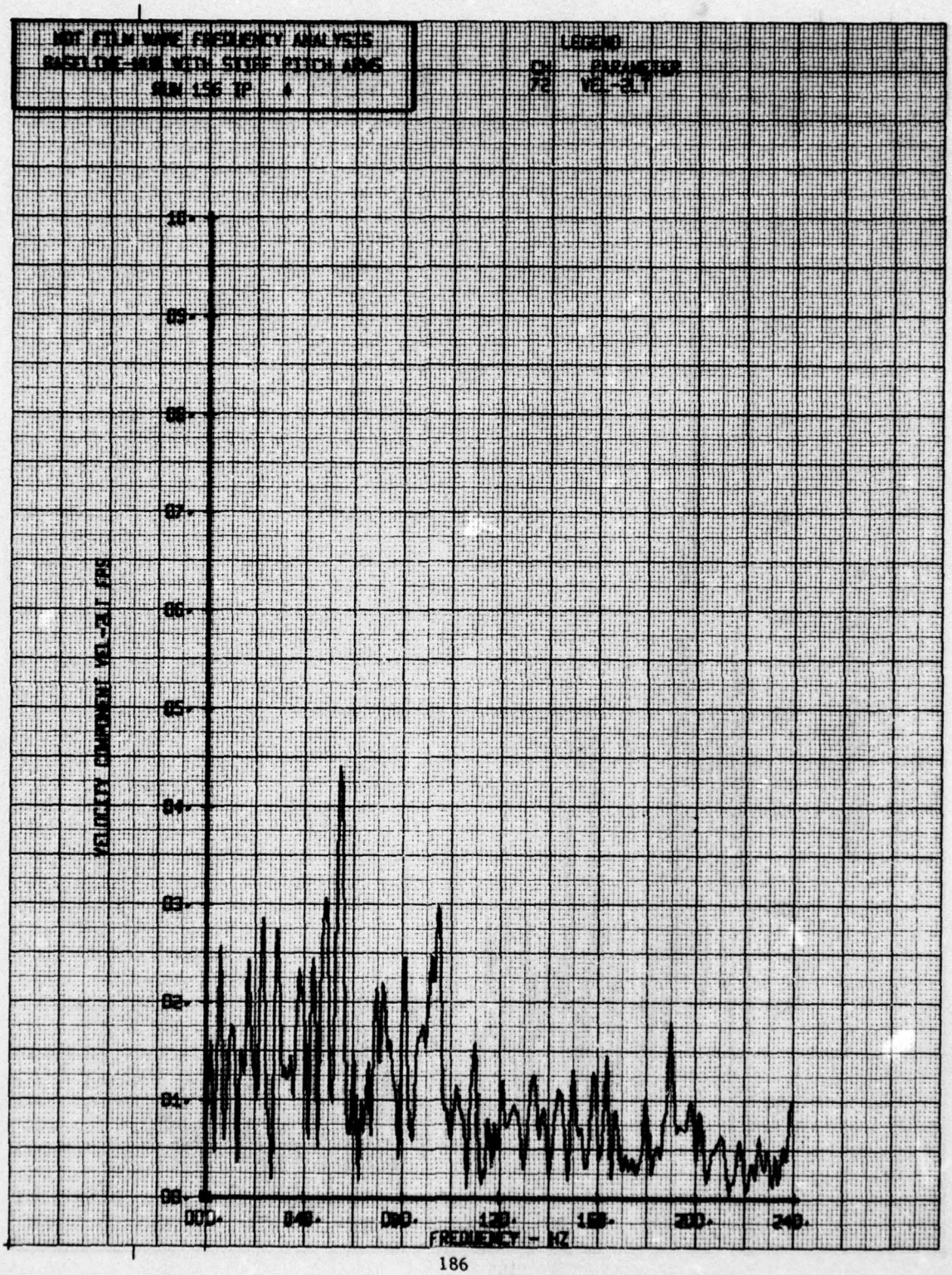

HOT FILM WAKE FREQUENCY ANALYSIS
AIRFOIL-WAKE WITH STEADY PITCH ANGLE
RUN 456 TP 6
LEGEND
PT PARAMETER
78 VEL-RLT
VELOCITY COMPONENT VEL-RLT (FPS)
FREQUENCY - HZ

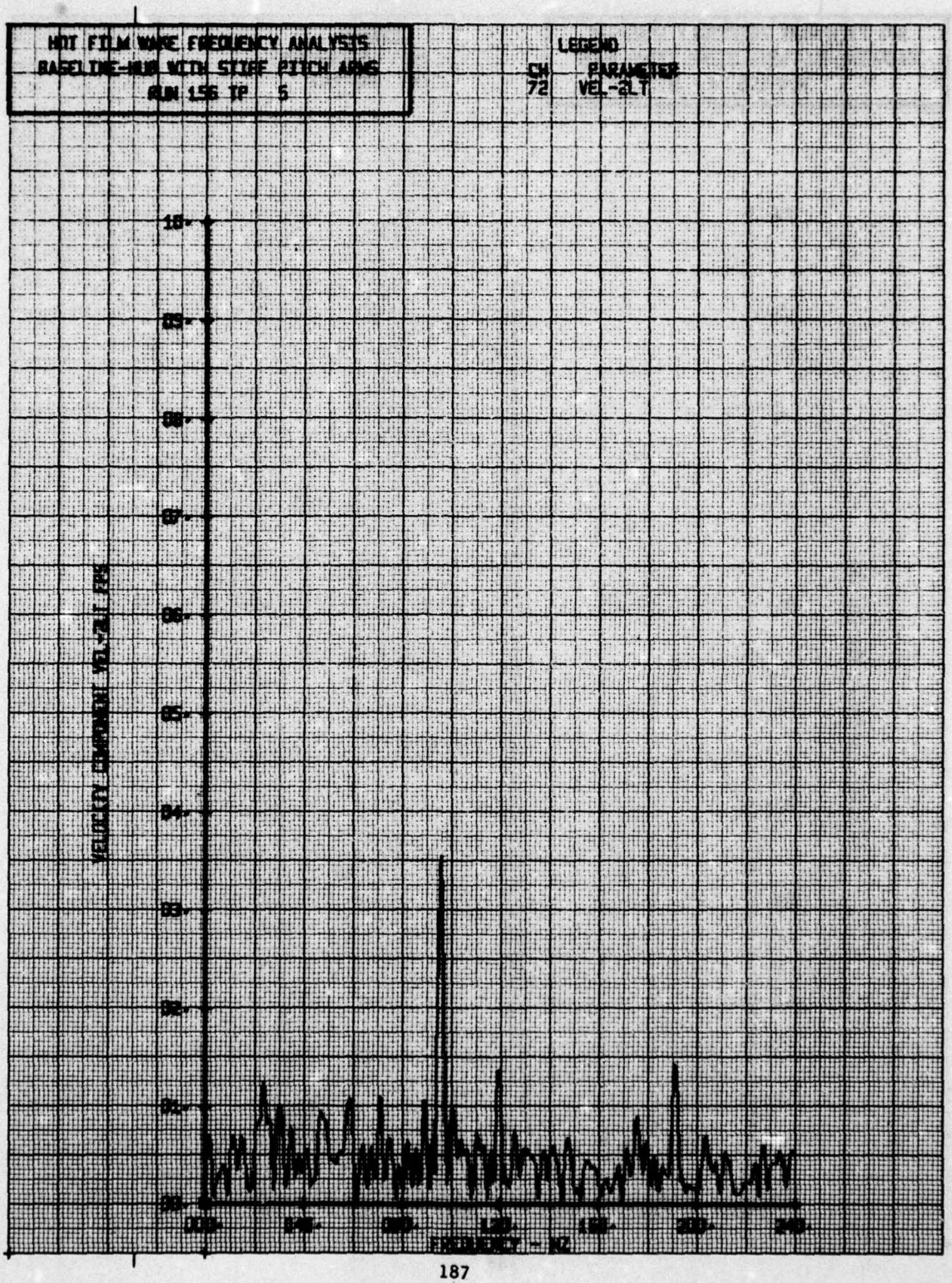

HOT FILM WAKE FREQUENCY ANALYSIS
RUN 135 TF F
LEGEND
CH PARAMETER
70 VEL.-SLT
VELOCITY COMPONENT VEL-SLT FT/
FREQUENCY - HZ

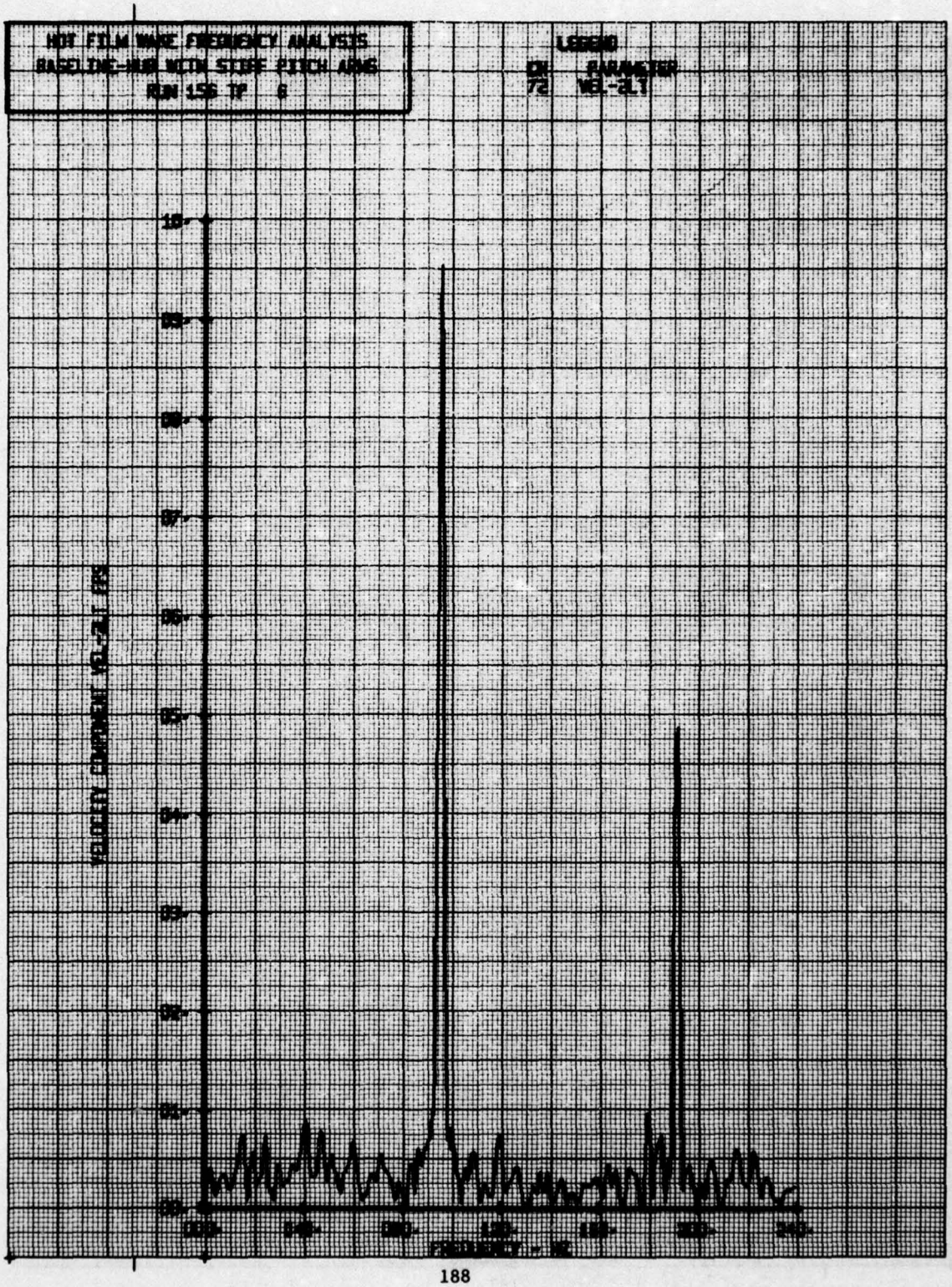

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-NEW WITH STIFF PITCH ARMS
RUN 156 TP 9
LEGEND
CH PARAMETER
70 VEL.-SLT
VELOCITY COMPONENT VEL-SLT FPS
FREQUENCY - HZ

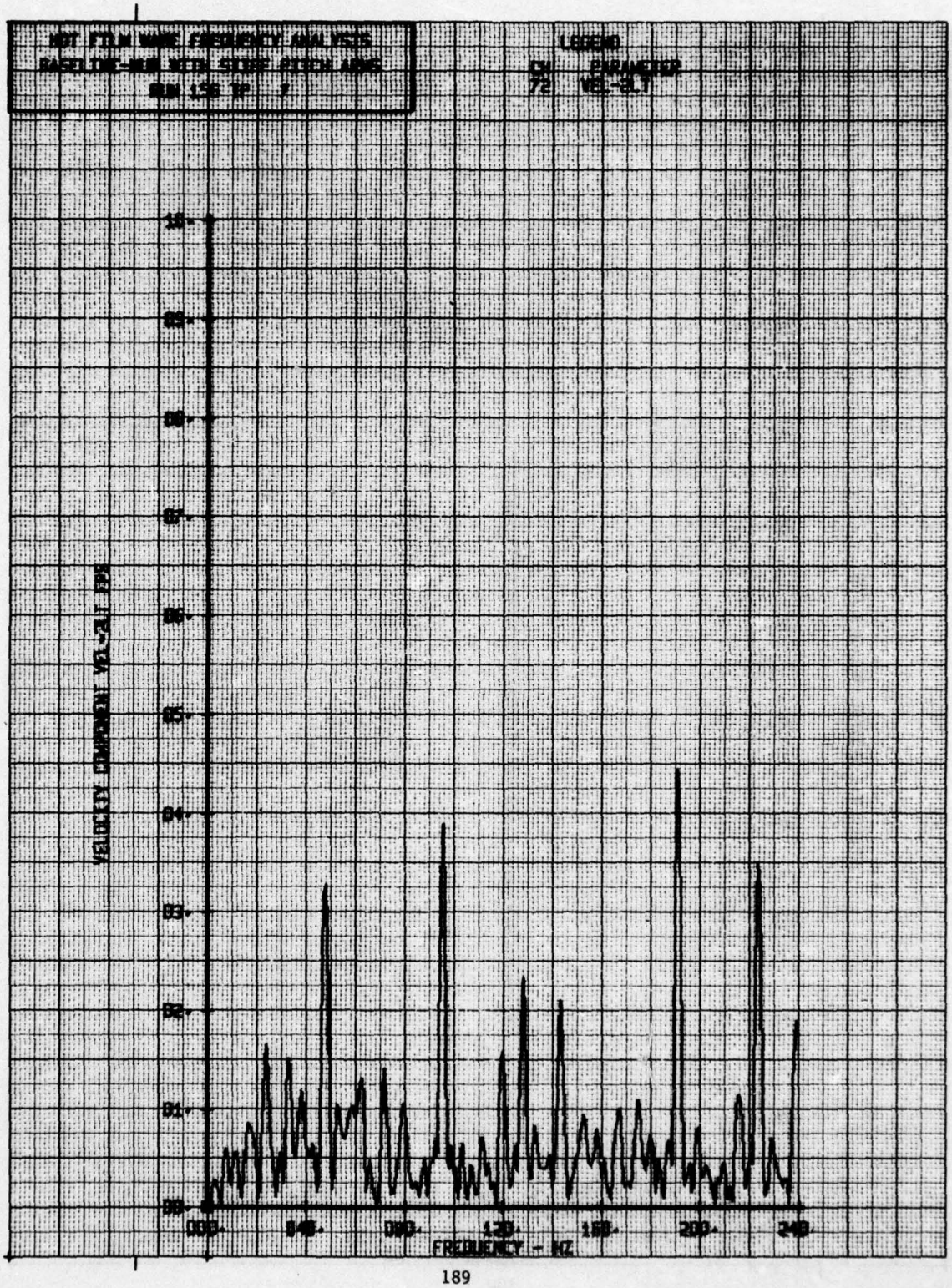

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-NEW WITH STIFF PITCH ARMS
RUN 156 TP 2
LEGEND
CH PARAMETER
72 VEL-3LT
VELOCITY COMPONENT VEL-3LT FPS

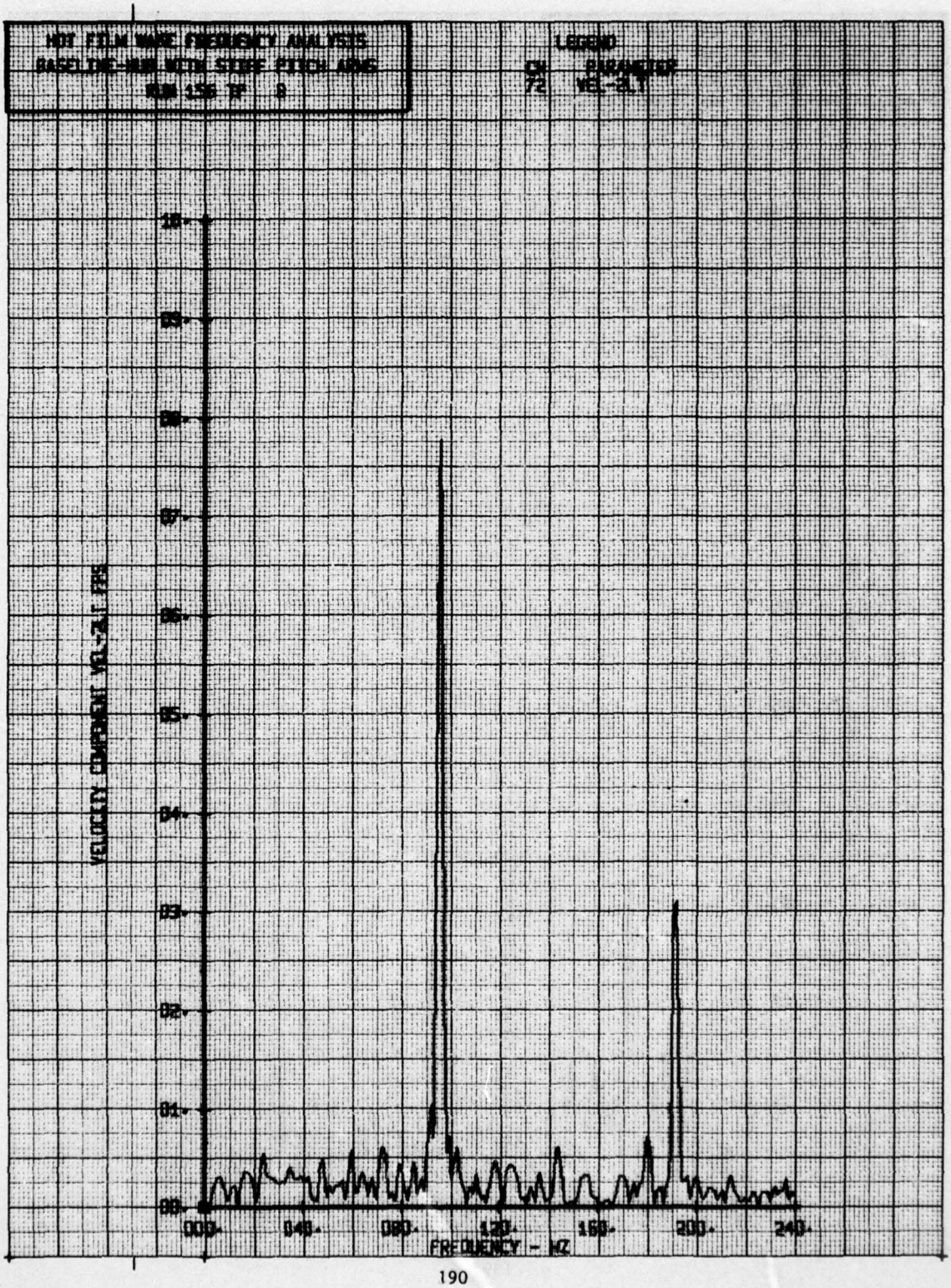

LEGEND
CH PARAMETER
72 VEL-ZLT
VELOCITY COMPONENT VEL-ZLT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
RUN 156 TP 4
LEGEND
CH PARAMETER
72 VEL-ALT
VELOCITY COMPONENT VEL-ALT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 5
LEGEND
CH PARAMETER
72 VEL-2LT
VELOCITY COMPONENT VOLTAGE RMS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STUFF PITCH ARMS
RUN 155 TF 6
LEGEND
ON PARAMETER
72 VEL-2LT
VELOCITY COMPONENT VEL-2LT FPS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-RUN WITH STUFF PITCH ARMS
RUN 156 RP 7
LEGEND
CH PARAMETER
72 VEL-ELT
VELOCITY COMPONENT VEL-ELT EDY
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-WAK WITH STIFF PITCH ARMS
RUN 156 TF 8
LEGEND
CH PARAMETER
72 VEL-2LF
VELOCITY COMPONENT VEL-2LF FPS
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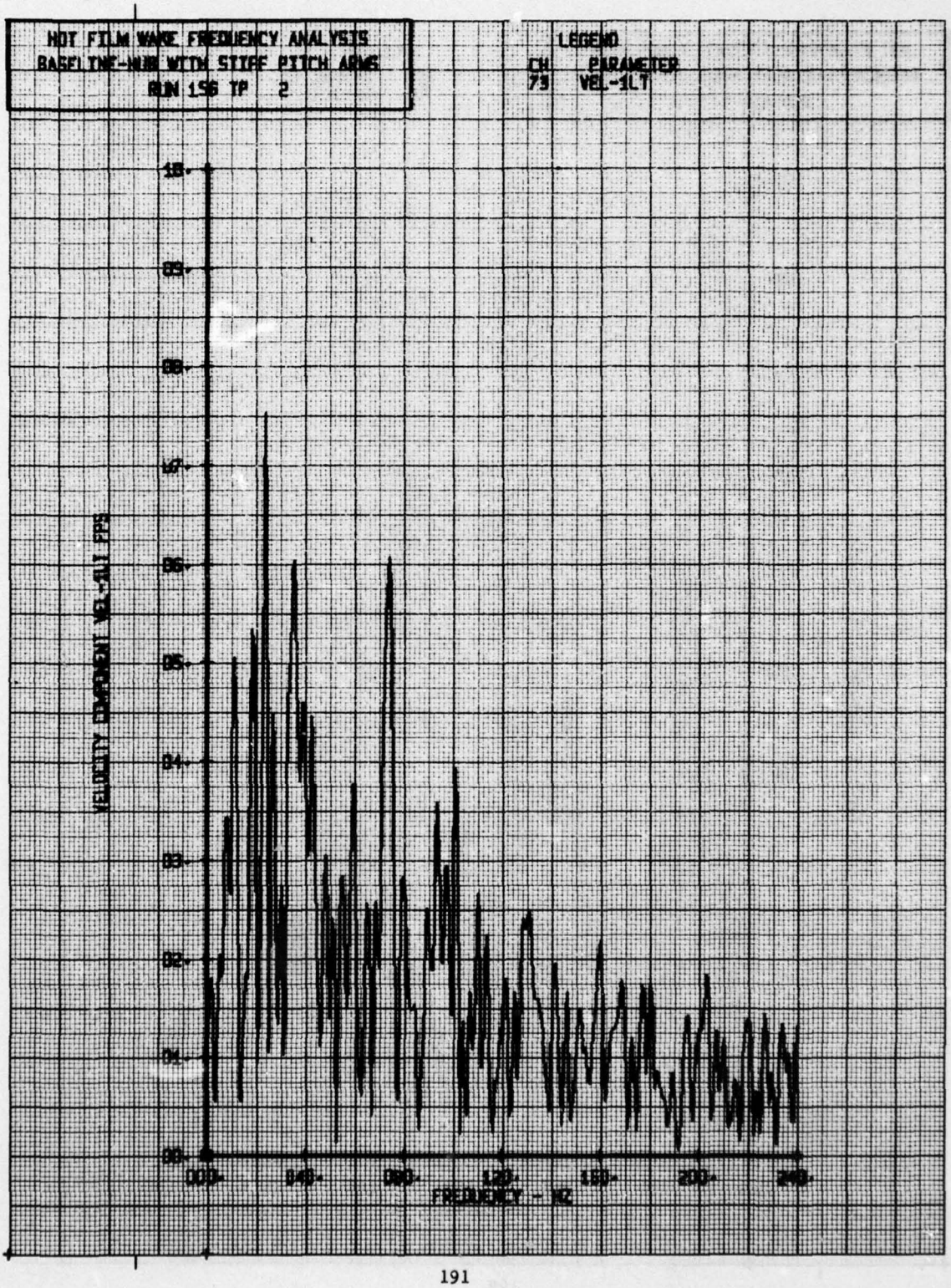
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 2
LEGEND
CH PARAMETER
73 VEL-1LT
VELOCITY COMPONENT VEL-1LT FPS
FREQUENCY - HZ